94
05
73
2

ENGINEERING AND

# BOILER HOUSE REVIEW

ESTABLISHED 1899

TWO SHILLINGS & SIXPENCE

VOL. 76 NO. 2 • THE PIONEER STEAM JOURNAL • FEBRUARY, 1961

THE Danfoss THERMOSTATIC RADIATOR VALVE TYPES RA AND RAD

for hot-water and low-pressure steam heating systems is the only available means of obtaining a simple, automatic temperature control geared to the heat requirements of the room at any time.

It is fitted on the radiator instead of the conventional manually-operated valve and is adjustable to any temperature between 40 and 80°F (5 and 25°C).

With the valve sizes ⅜", ½", ¾", 1" and 1¼" and three different types of phial, all cases encountered in actual practice will be covered.

*Send for our special leaflet*

Danfoss

LONDON-LIMITED
AUTOMATIC CONTROLS
AND EQUIPMENT

13, Queensway, London, W.2.
Telephone: BAYswater 9321

3103

# Here is one Oil Burner that brings efficiency SIMPLY to hand

The Burner shown has a maximum output of 12 gallons per hour and requires atomising air at 20" (51 cm) w.g. to 30" (76 cm) w.g. with oil at not less than 5 lbs per sq. in. (0.35 kgs per sq. cm) or equivalent head.

The outcome of 80 years' experience the Wallsend Self-Proportioning Low Air Pressure Oil Burner brings new ease and efficiency of control to oil burning. The single lever at the side automatically proportions oil and air quantities in the correct ratio and whatever the type of fuel.
It has, too, a turn down range of approximately 5 : 1 which can be achieved with a stable flame, efficient combustion and a high $CO_2$ content. Made with the well known Wallsend features of robustness, long service with little maintenance, and flexibility this outstanding burner leads the way, as well, to automatic or remote control of all single and multi-burner installations . . .

**THE WALLSEND SELF-PROPORTIONING LOW AIR PRESSURE BURNER**

**THE WALLSEND SLIPWAY & ENGINEERING COMPANY LIMITED**
WALLSEND-ON-TYNE
In association with **HUBBARD COMBUSTION LIMITED** Kingston on Thames WSE 35

# Engineering and BOILER HOUSE REVIEW

THE OLDEST ESTABLISHED STEAM ENGINEERING PUBLICATION

FEBRUARY 1961

VOLUME 76. No. 2


## Principal Contents


| | Page |
|---|---|
| EDITORIAL NOTE | 31 |
| POINTS AND POINTERS | 32 |
| SPONDON "H" GENERATING STATION | 34 |
| THE SUPERHEATER COMPANY LIMITED | 38 |
| POWER PLANT ENGINEERING DURING 1960 | 42 |
| STEAM AND POWER PLANT AT A FIBRE FACTORY | 48 |
| RECENT EQUIPMENT AND ACCESSORIES | 52 |
| OVERSEAS STEAM ENGINEERING PRACTICE | 58 |
| LATEST POWER PLANT PATENTS | 62 |
| NOTES—PERSONAL AND INDUSTRIAL | 66 |


*The Editor will be glad to receive and consider original contributions, correspondence, etc., of a suitable nature for publication. Stamped and addressed envelopes should be enclosed for the return of any matter considered unsuitable*


*Published monthly by*

ENGINEERING REVIEW PUBLISHING CO. LTD.
19-20, NOEL STREET, LONDON, W.1

*Annual Subscription Rate, 40s., including postage.*

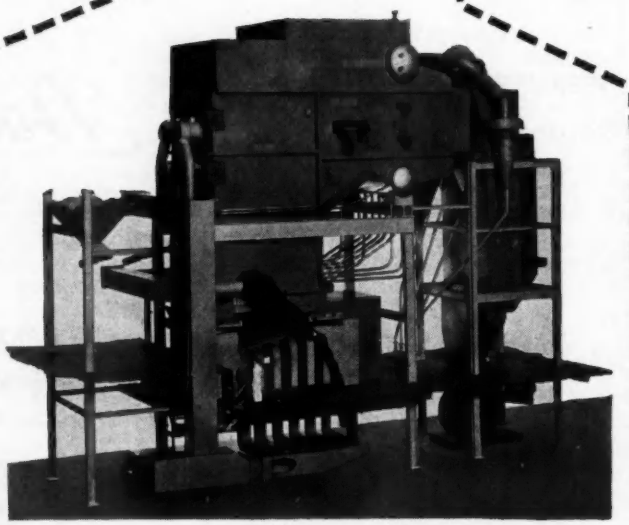
*Telephone*
Gerrard 8811

*Telegrams*
"Farsighted, Wesdo London"

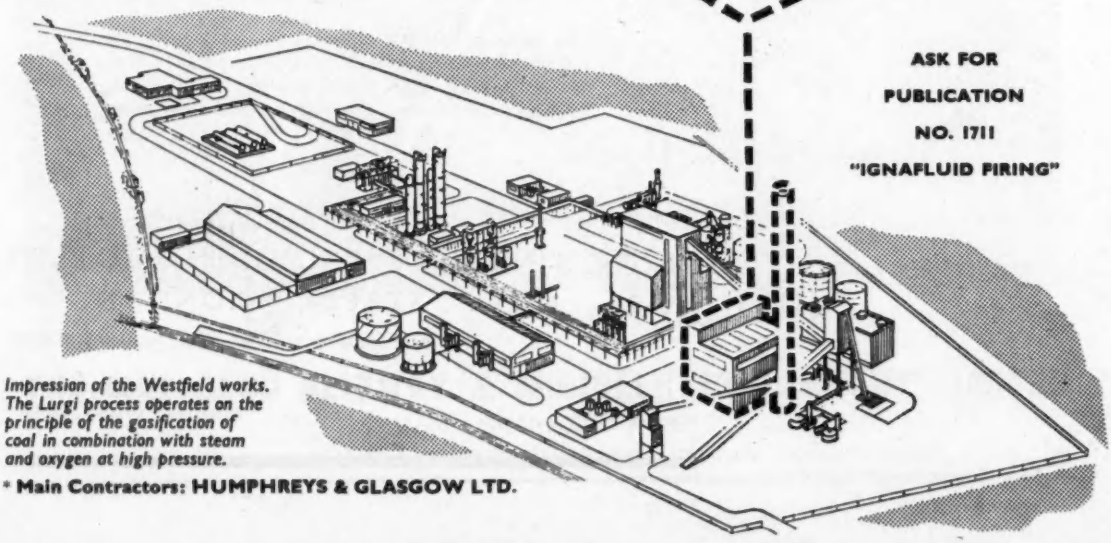
# BABCOCK BOILERS *with* ignafluid FIRING

## supply steam to Britain's first Lurgi high-pressure gasification plant

Three 45,000 lb./hr. Babcock Bi-drum boilers supply steam, at 450 lb./sq. in. to the new Lurgi high-pressure gasification plant of the Scottish Gas Board, at Westfield, Fife—first of its kind in Britain. This is also the first application in Britain of **Ignafluid firing,** developed by Babcock for the efficient combustion of fine, unmilled, low-grade fuels, including even coke-breeze dust and with ash-contents up to 40%, in boilers and some types of industrial furnace. The specification of Babcock boilers with **Ignafluid firing** is in keeping with the whole modern conception of the Westfield plant*, which is an important advance in British gas-production and in the development of the Scottish gas grid.



*Cut-away view (from a model) of a Bi-drum boiler with Ignafluid firing: showing the inclined travelling grate for slag-removal and divided ducting for the pulsating primary-air supply.*



*Impression of the Westfield works. The Lurgi process operates on the principle of the gasification of coal in combination with steam and oxygen at high pressure.*

*** Main Contractors: HUMPHREYS & GLASGOW LTD.**

**ASK FOR PUBLICATION NO. 1711 "IGNAFLUID FIRING"**

**BABCOCK & WILCOX LTD., BABCOCK HOUSE, 209 EUSTON ROAD, LONDON, N.W.1**

Engineering and
BOILER HOUSE REVIEW

FEBRUARY 1961
VOLUME 76 No. 2

## CONFIDENCE IN COAL

AT a conference in London on January 12th, which we attended, Sir James Bowman, the retiring chairman of the National Coal Board, reviewed the coal industry's progress during 1960, and the prospects for 1961.

There is no doubt that during the past four or five years there has, in the minds of the general public, been a general lack of both confidence and optimism in the future of the coal industry. In fact, there has been almost an element of gloom as regards its future development. But within the industry itself such gloom has not existed to any great degree and there has, in fact, been a continuous drive to dispel what gloom that has existed, because it was fully realised that any half-hearted enthusiasm for the future of coal could have a very adverse effect upon recruitment of workers in the industry.

There was certainly no indication of gloom or despondency in what was, perhaps, Sir James's farewell address as chairman of the Board. On the contrary, there was both plenty of optimism and an enthusiastic orecast as to what the future held for coal.

Sir James said that the contraction of the industry that has so clearly outlined the pattern of development during the past few years is now virtually complete, and the industry faces the future as a compact, highly efficient unit, organised to serve the fuel requirements of the nation as well as it possibly can. During 1960 the Board had sold 10 million tons more coal than it did in 1959. Power station boiler furnaces had consumed 5 million tons more than in 1959, coke oven consumption was nearly 3 million higher, and the domestic market took 2 million tons more. Coal output, Sir James added, was held below the level of demand during the year, and the Board had lifted more than 6 million tons from its undistributed stocks. Productivity in the industry had continued its upward climb during the year, output per manshift for all workers at nearly 28 cwt. being nearly 4 per cent. higher, and coalface productivity at nearly 80 cwt., being 6 per cent. higher than in 1959.

Compared with 1957, Sir James said rigid economy and a high rate of efficiency represented savings in 1960 at the rate of approximately £50 million a year; but even so, the Board had carried heavy financial burdens from stocking and from the loss of highly profitable opencast output. During 1960, 44 pits were closed—thus bringing the total number of closures in the last three years to 136, of which 83 were caused by complete or virtual exhaustion of reserves or because of mergers. The admirable manner in which the contraction of the industry has been carried out is adequate evidence of the careful consideration that was given to each and every closure.

In 1958, the weekly average manpower was 692,700, but last year, this had been reduced to 602,100 as a result of the Board's deliberate policy of restricting recruitment and not filling the vacancies caused by wastage. Despite the severity of this cut in manpower, heavy redundancy and the intense social problems usually associated with schemes of this nature have been completely avoided.

The number of major colliery reconstructions completed during 1960 was 33, and another 127 schemes are still in progress. Capital expenditure during the year, was about £90 million, which was about £20 million less than in 1959, the peak year from the point of view of expenditure. The Board does not expect that there will be any reduction in the level of expenditure in the plans previously announced for the period up to 1965.

Commenting on the industry's prospects for 1961, Sir James said that subject to any unforeseen changes in the economy, it had been estimated that total consumption would be about the same as in 1960, and production would be regulated at a level which would enable demands for different types of coal to be met, while allowing further reductions in the Board's stocks. Efficiency was now at the highest peak ever reached, Sir James went on to say, and higher levels would be attained in 1961, when there would be a further rapid increase in mechanised output and concentration of working. The industry, he added, would improve its competitive strength during this year.

Thus, the outlook for coal does not, after all, seem to be so unfavourable. The closing down of older pits in favour of newer and modernised ones, more economic to work, combined with increasing mechanisation, should make it possible to hold the price of coal relatively stable. It should be possible to quote prices competitive for many purposes—even, perhaps, to revive the industry's export trade.

# Points and Pointers

*CO-OPERATION IN ELECTRICAL EXPORTS*

A meeting held in London on January 17th, of over 130 export managers and senior executives of the electrical industry—with exports already approaching nearly £300 million—welcomed the suggestion that their trade association (B.E.A.M.A.) should make immediate arrangements to put firms in touch with makers of complementary equipment with a view to joint sales efforts, joint market research and collective exhibitions overseas. The first step will be the completion of a confidential questionnaire by each of the firms represented—ranging from the smallest electric switch to the largest power station plant—which will enable the Association to bring together firms wishing to co-operate in export promotion. In replying to the questionnaire, the firms will give details of the products they wish to export, the overseas territories in which they would like to co-operate, any existing overseas facilities they would be prepared to share and whether they would like to co-operate with firms in other industries. Representatives at the meeting drew attention to the many advantages of pooling resources in the most competitive markets, bearing in mind the high cost of maintaining fully-trained and experienced sales engineers abroad. There was also a suggestion of sending to overseas territories, including countries behind the Iron Curtain, small teams representing groups of manufacturers. Several of the largest firms in the electrical industry offered to provide help to smaller firms manufacturing complementary products, by sharing their overseas facilities. Electrical and allied products represent about one-tenth of all British exports of manufactured goods. The idea of this export drive follows the clear lead given at the British Electrical Power Convention held during June last year, when members of not only the manufacturing industry, but also the electricity supply industry urged the necessity for co-operation in the promotion of electrical exports. At a time when Britain's prosperity is in the balance the B.E.A.M.A.—which this year celebrates its Golden Jubilee—is thus giving top priority in its jubilee activities to furthering the export drive.

*NUCLEAR TRANSLATION POOL*

The European Atomic Energy Community (Euratom), the United Kingdom Atomic Energy Authority, and the United States Atomic Energy Commission have agreed to pool their efforts to collect and disseminate information concerning translations of nuclear literature—especially from such languages, unfamiliar to Western readers, as Russian and Japanese. A central information office "Transatom" has, therefore, been established at Euratom's Brussels headquarters. It will function in two ways: first, by publishing from now onwards, a monthly Transatom bulletin, which will list existing translations recently reported to the Brussels office, as well as new translations planned by international or national institutions and private firms in the European Community, the United States, the United Kingdom and in other countries. Secondly, all data relating to translations, including those made before the establishment of Transatom, are to be collected and recorded in a master file at Brussels. Copies of this card file have been offered to appropriate institutions in countries with an interest in the nuclear field. Contacts have been established in order to avoid duplication of work when the European translation centre, to be established at Delft, is set up. The scope of this institution is much wider, as it will cover all scientific and technical material in the field of the exact sciences.

*B.I.M.C.A.M.*

The annual luncheon of B.I.M.C.A.M. (The British Industrial Measuring and Control Apparatus Manufacturers' Association) was held at the Hyde Park Hotel, London, on Tuesday, January 17th, nearly 250 members and guests being present. Mr. W. G. Thomas (Bailey Meters & Controls Limited), president of the association, presided, and the principal guest was The Rt. Hon. Lord Mills, P.C., K.B.E., Paymaster General. Following the Loyal Toast, the toast "The Institution," was proposed by Lord Mills, who afterwards paid tribute to the continued good work of the Association and its members, and mentioned the extreme importance of modern instrumentation equipment for use, both in this country and for export. The vast saving in labour, and operating costs as the result of efficient instrumentation is, perhaps, more necessary today than ever before. He congratulated the Association upon the progress made, and wished both the Association and its members continued success in the future. The toast was responded to by Mr. W. T. Marchment (Evershed & Vignoles Limited), chairman of B.I.M.C.A.M. He thanked Lord Mills for his complimentary remarks regarding the Association. In the post-war years the level of demand for industrial measuring and control instruments has risen steadily, until today at the beginning of the nuclear age, it is higher than ever before. This rise may, in part, be attributed to a number of major developments and projects sponsored by nationalised bodies and by large industrial undertakings, but in the main, it is due to a realisation by industry of the many benefits to be gained by the installation of correct instrumentation. The toast "The Guests" was proposed by Mr. Thomas, the president, who welcomed the guests and named some of the principal ones. The toast was replied to by Mr. G. C. Eltenton (president, Society of Instrument Technology). The British Industrial Measuring and Control Apparatus

Manufacturers' Association, which was inaugurated in January, 1944, is an association of British manufacturers of industrial instruments for measurement and automatic control, freely uniting in their common interest to further the development and efficiency of their industry. Most substantial and progressive firms are now in membership. The Association is the recognised point of contact with the manufacturing industries and public authorities using its members' products, and contains within its membership the most important firms in the United Kingdom engaged in industrial instrumentation.

*NAVAL ENGINEERING STUDENTS' VISIT TO JOHN THOMPSON LIMITED*

Nineteen students from the Royal Naval Engineering Course at Manadon, Plymouth, were the guests of the John Thompson Engineering Works, at Ettingshall, Wolverhampton, on Thursday, January 5th. The students, all of whom are studying propulsion systems in marine vessels, including nuclear power units, made the visit, which was arranged by Captain M. A. L. Cooper, M.B.E., R.N., who is Admiralty District Engineer Overseer. During their visit, the students were shown a film describing Berkeley Nuclear Power Station, they took part in a discussion on nuclear power propulsion, with Mr. Cornish of the John Thompson organisation, and joined main board directors for lunch. Earlier, they had attended lectures by John Thompson specialists on water-tube and marine boiler design, forced and natural circulation, and pressure combustion, with reference to high pressure re-heat application and steam catapult boilers. During the afternoon, the students made a tour of the works of John Thompson Limited, and visited the La Mont Boiler and Pipework, and Research departments. As is well known, the John Thompson group of companies serve many industries with a wide range of products. John Thompson produce complete steam-raising plant, special vessels for the chemical and petroleum industries, pressings for the motor industry, sewage-disposal plant and many others. With such a wide range of activities, the group requires a wide range of research to be carried out. For this purpose the John Thompson Group Research Centre was established some three years ago. The purpose of the Centre is not to carry out fundamental research, but to investigate and provide answers to specific problems passed on to it by Group companies. Many of these problems are concerned with research and development related to manufacturing methods, but a large proportion of the work of the department is in connection with customers' problems.

*TECHNICAL EDUCATION*

A major reconstruction of the system of courses for technicians, craftsmen and operatives in technical colleges is proposed in the White Paper "Better Opportunities in Technical Education," which was published on January 5th. The changes proposed, have four main objects. They are intended to broaden the education received by students, and to provide the maximum continuity between education at school and technical college. Secondly, they will adapt the system more closely to the needs of industry, and in particular meet the urgent need to make more and better provision for technicians. Thirdly, they will increase the variety of courses available to students according to their aptitudes and the careers they wish to follow. Fourthly, the White Paper states, they should substantially reduce the wastage which occurs at present owing to the failure of so many students to complete their courses successfully. The chief proposals are as follows:—Students should commence at a technical college immediately after leaving school. Preliminary courses in evening institutes should be discontinued, but more care should be taken in the selection of students for courses. Colleges should experiment with full-time induction courses and with tutorial methods. The courses will include National Certificate and Diploma courses for students aiming to become at least high-grade technicians; technician courses devised specifically for particular industries; craft courses; and courses for operatives. Ordinary National Certificate courses will last two, instead of three, years, and the standards of entry will be raised. There will be new courses of four to five years specially for technicians, while new general courses will be introduced, leading to either technician courses or Ordinary National Certificate and Diploma courses. Craft courses will be modified, while the courses for operatives should be vigorously developed. More time should be provided under day release schemes. No student should have to rely wholly on evening study. Sandwich courses, especially for technicians, and block release courses should be increasingly developed. Commenting on the proposals, at a press conference held on January 5th, Sir David Eccles, Minister of Education, said that in future, the intention was that the last years at school and the first years in work should be, and should be seen to be, a continuous period of education.

*EUROPEAN TRADE MISSIONS*

Fact-finding missions composed of leading business men and industrialists drawn from the 30 members of the Export Council for Europe, are to be sent to Europe to confer and work in close co-operation with the commercial representatives of the British Government, British trading interests, existing importers of British goods and all other appropriate bodies. This step was agreed at the second meeting of the Export Council for Europe, held on January 11th, under the chairmanship of Sir William McFadzean. Nine teams of three men will leave during this month to visit Britain's six partners in the European Free Trade Association (Austria, Denmark, Norway, Portugal, Sweden, Switzerland), and also France, Italy and Spain. The remaining 10 countries covered by the Council will be visited by similar-sized missions during May and June. Discussions on the spot will be on the basis of a questionnaire covering market needs; competition from other countries; questions of price, quality and design; and study of successful British export efforts as well as investigation of complaints where these are well-founded. The advisability of inviting buying missions to visit the United Kingdom will be explored. The findings of these teams will be collated immediately, and used to guide the Council in its future programme of work. Certain other steps were agreed to promote interest in Western European markets at home and it was also decided to hold a national convention in the autumn of this year.

# Spondon "H" Generating Station

*Spondon "H" generating station is of more than usual interest as the plant is designed to deliver a supply of back-pressure steam from three 10-MW turbo-generator sets, to the adjacent works, of Courtaulds Limited, for process requirements. The plant comprises four boilers and three turbo-generator sets, the last boiler and set having been commissioned some four months ago.*

WE have recently received details of the four 180,000 lb./hr. stoker-fired boilers designed and built by Foster Wheeler Limited, for the Central Electricity Generating Board's Spondon "H" power station ("H" stands for heat), which is an extension to the Spondon "A" station. The new station is situated on the west bank of the River Derwent, immediately north of the "A" station, and about four miles south-east of Derby.

In addition to the four boiler units, the plant at Spondon "H" includes three back-pressure turbo-generators, with three pressure-reducing valves arranged as standby to the turbines.

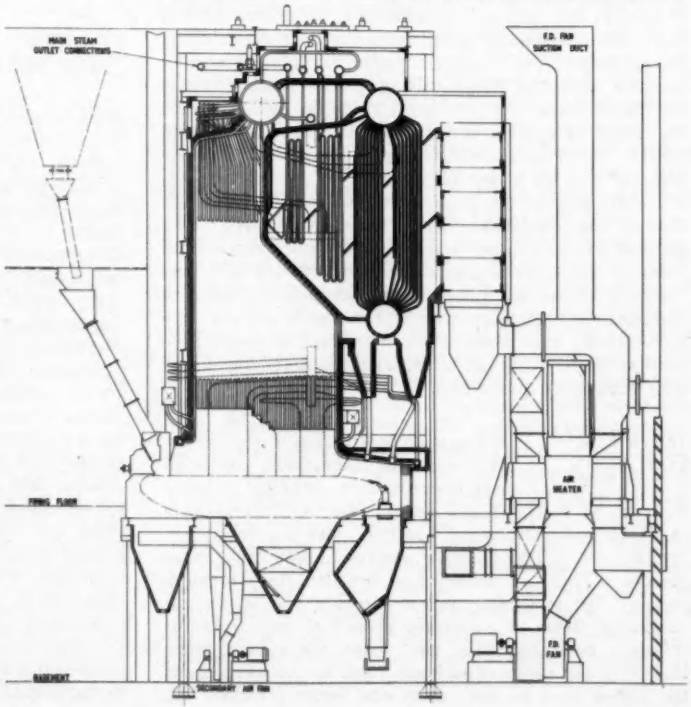
Primarily designed for supplying process steam to the adjacent works of Courtaulds Limited, this station is the outcome of a contract between the then Central Electricity Authority and British Celanese Limited (now Courtaulds Limited). The present long-term contract with the C.E.G.B. is for the supply of up to 500,000 lb./hr. of steam to the factory. Site work commenced in July, 1956, and the last boiler and back-pressure turbo-generator were commissioned during September and October, 1960.

## Boiler plant

The boilers are dual-circulation units which were designed to use feedwater in the form of warm river water, treated in a simple process-softening plant, and which would otherwise be considered unsuitable with the boiler operating conditions obtaining. As no condensate is returned from the works of Courtaulds Limited, plant capable of treating 100 per cent. make-up is provided, the raw water being supplied at a temperature of 125-140 deg. F. by Courtaulds. The boilers are of the three-drum, water-tube type, and are stoker-fired. Each has a maximum rating of 180,000 lb./hr. when operating under the following conditions: Superheater outlet pressure at m.c.r.—950 lb./sq. in. g., superheater outlet temperature at m.c.r.—985 deg. F., feed temperature at economiser inlet at m.c.r—360 deg. F.

The primary (front) circuit is kept at a relatively low concentration by continuous blowdown from the front steam drum to the rear steam drum through six 4 in. o.d. water circulators, the flow being achieved by placing the rear drum centre line 5-in. below that of the front drum. Steam generated in the rear drum is led to the front drum through thirty-eight $3\frac{1}{4}$ in. o.d. tubes. It enters a separate compartment in the side of the drum where it serves to raise the temperature of the incoming feed, which is sprayed from the feed pipe, and is itself partially condensed.

The primary or low-concentration circuit is formed by the furnace water-walls which consist of open-spaced $3\frac{1}{2}$ in. o.d. tubes. Water from the front steam drum is fed to the front, rear, and side-walls of the furnace by a $10\frac{3}{4}$ in. i.d. downcomer on either side of the boiler. The front and rear-wall tubes lead directly into the drum; the front-wall tubes also forming the roof tubes, and the rear wall tubes open out to form a two-row slag-screen at the furnace exit. At the level of the water drum, the rear-wall begins to slope towards the front of the boiler and becomes vertical again on the centre-line of the front steam drum. Some of the side-wall tubes extend to the furnace roof and lead directly to the drum, whilst the




*Sectional outline arrangement of one of the 180,000 lb./hr., three-drum, dual circulation type, stoker-fired boiler units which were supplied by Foster Wheeler Limited.*

remainder terminate in a header, at approximately the same level as the rear wall reassumes its vertical position. Risers convey the steam and water mixture from this header to the drum.

The second or highly-concentrated circuit comprises two vertical convection banks formed of 2 in. dia. tubes between the rear steam drum and the water drum, water flowing down the bank furthest from the furnace and up the front bank. A row of 3¼ in. dia. tubes connected between these drums serves to form the rear-wall of the superheater cavity. Two 6-in. bore downcomers are connected, one each side, between the steam drum and water drums in order to assist circulation in the convection bank.

The temperature of the steam is controlled by condensing a small proportion of the saturated steam before it enters the superheater. The moisture thus formed mixes with the in-going saturated steam, and by taking up latent heat in the superheater, reduces the final overall steam temperature to the required value. The condensation of the necessary quantity of saturated steam is by means of a shell-and-tube type heat-exchanger, or control condenser, which forms the superheater inlet header. Saturated steam entering this header passes over a horizontal tube-bundle which carries circulated cool feedwater, which in turn by-passes the economiser, and flows via the control condenser to rejoin the main feed flow at a point between the economiser outlet and the steam drum.

A control-valve is included in the condenser water circuit to maintain the quantity of cooling water at the required value. The valve is governed by a regulator, responding to final steam temperature and other conditions.

The control condenser, supplied by Foster Wheeler Limited, is composed of two separate tube banks, one inserted from either end of the superheater inlet header. Each tube bank comprises a bundle of horizontal U-tube elements, expanded into a tube-plate, and so arranged that provision is made for four water passes through the tubes by suitable baffling in the water box. The tubes are ⅝ in. o.d. and 16 S.W.G. thick. To ensure rapid and uniform distribution of condensate to all superheater elements, special drainage troughs are provided on the steam side of the tube banks.

**Fuel supplies**

Coal is delivered to the station either by rail, using bottom discharge wagons into ground hoppers, or by road. The Derbyshire coal, which is of 1½ in. sizing, has an average calorific value of 10,500 B.Th.U./lb. and the combined daily consumption of the four boilers is 1,194 tons at m.c.r. A complete fuel-handling system for the "H" station was supplied by International Combustion Products Limited. It comprises road and rail receiving hoppers, belt-conveyors and chutes, and is capable of handling up to 300 tons/hr. of coal into the boiler house, or 150 tons/hr. out to the stockpile. The coal storage area is common to both the "A" and "H" stations. From the weighers, which are located in the conveyor junction-tower, automatic travelling-belt shuttle conveyors feed the coal to one or more bunkers as required. Each of the boiler bunkers has a capacity of 300 tons—sufficient for 33 hours' operation at full load. The coal is fed through chutes from these bunkers to automatic weighers, and thence to the chain-grate stokers serving the boilers. The chain-grate stokers which fire the boilers are twin-grate units having a total width of 23 ft. and a length of 23 ft. giving a total grate area for each boiler of 529 sq. ft. These "L" type stokers, which were supplied by International Combustion Limited, are each driven by a variable-speed 4/1 h.p., 415 V, 1,440/360 r.p.m. motor controlled by an induction regulator—this being governed by a pilot motor which is under the boiler operator's control. The maximum and minimum speeds of the grate are respectively 1.25 and 0.41 ft./min. Riddlings and fine ash are collected in hoppers, located beneath the stokers, from which they are allowed to fall continuously on to a submerged ash-conveyor system, supplied by John Thompson Conveyor Company. The conveyor system consists of a rubber conveyor-belt submerged in water which is contained in a steel trough. In order to prevent air leakage from the furnace, and any consequent disturbance to boiler firing, the ash-hopper doors are opened below water-level. The conveyor system discharges the coal into a storage bunker from which final disposal is by road transport.

*Boiler firing aisle showing (left) the fronts of the International Combustion twin-grate stokers, and on the right, the James Gordon boiler instrument and control panels.*

The dust-handling plant supplied by John Thompson Industrial Constructions Limited, comprises a dry vacuum system—exhausters being located in the base of the chimney, and dust storage-containers supported on the ash-bunkers to which they discharge. Multi-cyclone dust collectors, which are equipped with secondary cyclone collectors and booster fans, are located on the inlet side of the I.D. fans.

**Back-pressure turbine-generator plant**

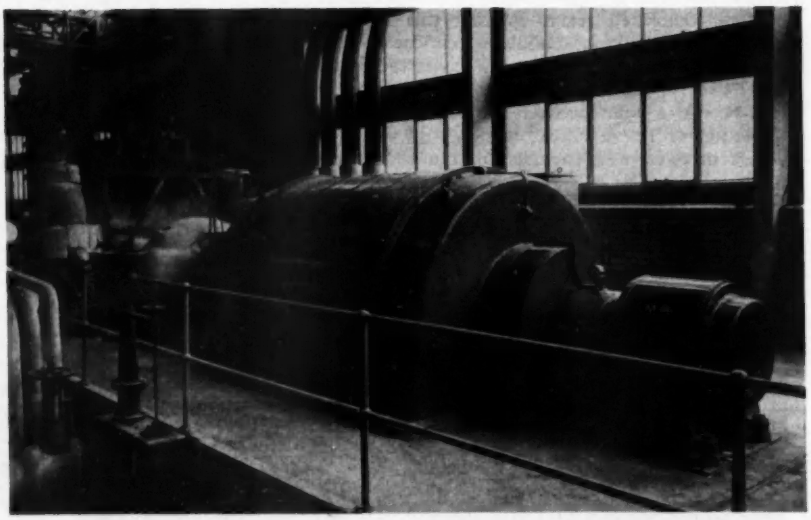
The three single-cylinder, back-pressure turbo-generator sets were supplied by Associated Electrical Industries Limited. Each is rated at 10.2-MW, with steam conditions at the turbine stop-valve of 900 lb./sq. in. and 875 deg. F. The steam consumption for each set, including feed-heating is 24.56 lb./kWh at m.c.r. After expansion through the turbine, the steam is exhausted at a pressure of 160 lb./sq. in. g. with superheat temperature of 520 deg. F. At the specified conditions, each set passes 205,000 lb./hr. of steam for process requirements.

Feedwater is supplied by four Sulzer feed pumps each capable of delivering 300,000 lb./hr. Each pump is rated at 100 per cent. duty and is driven by a 600 h.p., 3.3 kV, 2,950 r.p.m., induction motor manufactured by Associated Electrical Industries Limited. Two steam-driven feed pumps also rated at 300,000 lb./hr., are provided, in view of the fact that the boilers, which are fitted with the chain-grate stokers, cannot be shut down immediately. The pressure on the inlet side of the pumps is 50 lb./sq. in., and they discharge at 1,250 lb./sq. in. All the pumps are of barrel-casing construction with casings of steel, and all internal parts are manufactured in stainless-steel.

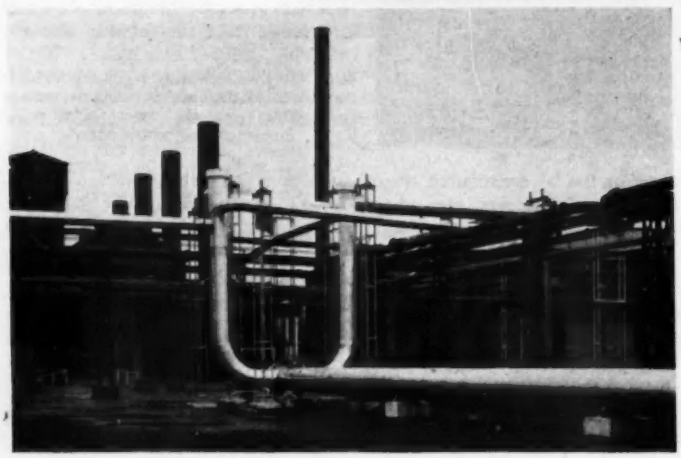
The feedwater is passed through an economiser supplied by Senior Economisers Limited and is admitted to the front primary boiler drum. Owing to rapid heating in the primary section of the boiler, silica and other solids are held in suspension in the primary steam drum and removed to the secondary steam drum by a continuous blow-down system which also acts as a feed-supply for the secondary section. In the secondary section, the connection is a slow process and the solids are deposited; the concentration of solids in the primary section is, therefore, at a much lower value than that in the secondary section. Steam produced in the secondary rear steam drum is returned to the primary steam and water drum where it is condensed in a special section. There is no carry-over of silica and other solids in this steam path. Steam from the primary section is then passed to the superheater.

The water-treatment plant supplied by The Permutit Co. Ltd., is one of the largest plants ordered by the Central Electricity Generating Board and is capable of dealing with 18 million lb./day (765,000 lb./hr.) at an average temperature of 228 deg. F. The plant is of the Hot Lime/Hot Zeolite softening type and consists of eight large pressure-filters which clarify the incoming water, two 24 ft. dia. hot lime reaction-tanks which soften the water and reduce silica content, and three large Permutit Ion exchange softeners for reducing hardness to zero.

*(Right). One of the 10,000 kW, single-cylinder, back-pressure turbo-generator sets supplied by A.E.I. Ltd. Turbine stop-valve steam conditions are 900 lb./sq. in. and 875 deg. F.*



*(Below). Part of the 2,140 ft. long, aluminium clad process steam main which carries the steam from the power station to the adjacent factory of Courtaulds Ltd. In the centre are the distribution yoke and associated feeder pipes.*



**Draught plant**

The forced and induced-draught fans, secondary-air fans and Ljungström air-preheaters were all supplied by James Howden and Co. Ltd. The forced-draught fans are each rated at 20,350 cu. ft./min. and are driven by 58 h.p., 415 V, 985 r.p.m. constant-speed motors. There are two

F.D. fans per boiler, and the air for combustion is drawn from the top of the boiler house, and discharged to a Howden Ljungström rotary air-preheater.

There are also two induced-draught fans per boiler. These are of the centrifugal type, and each is rated at 34,750 cu. ft./min., and driven by a variable-speed induction motor, regulator-controlled, rated at 174/12 h.p., 750/300 r.p.m., 3.3-kV. The two secondary-air fans per boiler draw off from the front dust-hopper or from the primary-air-ducting, and discharge to an insulated duct which encircles the furnace, and supplies over-fire air through nozzles located on the furnace front and rear walls.

**Instruments and controls**

The main boiler instrument panels were supplied by James Gordon & Co. Ltd., these panels carrying the Gordon automatic boiler control equipment comprising superheat temperature control, furnace pressure control and remote damper control. The temperature of the superheated steam is controlled by Foster Wheeler steam temperature control condensers, and also a James Gordon temperature control system. Thermostats measure the temperature of steam leaving the superheater, and changes in the rate of air-flow are detected at tapping points located on each side of a venturi installed in the ducting on the suction side of the F.D. fans. Changes in the rate of flow of combustion air will obviously be noticed before any change in the steam temperature becomes apparent and with this fact in mind the air-flow signal has been designed to act as an over-ride to the steam temperature signal. The final control signal is designed to vary the flow of feedwater to the control condenser. The dryness fraction of the steam is, therefore, reduced in proportion to the amount of feedwater, and this reduces the final steam temperature. Hagan automatic combustion control equipment has been supplied by James Gordon and Co. Ltd., and is designed automatically to regulate the furnace pressure, whilst combustion and secondary-air flow are manually regulated. Control of water level in the boiler drums is by means of Copes " Flowmatic " regulators.

Each of the three turbines has a by-pass system which, in the event of a turbine trip, is brought in automatically. The by-pass system has been designed to pass 250,000 lb./hr. of steam through Hopkinsons pressure-reducing and primary desuperheating equipment, reducing the pressure from 950 to 170 lb./sq. in., and the temperature from 895 to 520 deg. F. Secondary desuperheaters have also been provided, each of which has a capacity of 600,000 lb./hr. and designed to maintain the steam temperature at between 510-520 deg. F., after it has passed through the turbine or by-pass units.

Stand-by pressure-reducing and desuperheating equipment is also provided, and this provides process steam from the " A " station as an emergency short-term measure. This equipment is designed for a duty of 100,000 lb./hr., reducing the pressure from 370 to 170 lb./sq. in., and the temperature from 750 to 510/520 deg. F.

The station is controlled from a combined plant and main electrical control room with generator, 3.3, 11 and 33 kV control panels. Also contained in this room is a comprehensive mimic control panel covering the main points in the steam and water circuits. Two supplementary panels are also provided and these carry a full range of recording instruments. All three panels were supplied by Elliott Brothers (London) Limited.

**Steam distribution**

The main steam pipework within the boilerhouse, and the transmission pipework for carrying the back-pressure steam to the Courtauld factory, was supplied by Aiton and Co. Ltd. Steam from each boiler passes through an 8-in. bore h.p. steam header and the three back-pressure turbines and three pressure-reducing valves are connected in parallel between the h.p. steam header and the back-pressure mains. The steam in the two 21-in. bore back-pressure mains passes into the 30-in. bore main, which is approximately 2,140 ft. in length, and this conveys the process steam to the factory of Courtaulds Limited.

The pipework insulation was carried out by Thomas Cotton Limited, using materials supplied by Cape Insulation and Asbestos Products Limited. In the case of the 30-in. steam main, " Caposite " asbestos bevelled lags, 3½ in. thick have been used. Secured by 1 in. mesh wire-netting it is coated with ½ in. thickness of hard-setting composition. " Rocksil " wired mattresses were used for the 22 in. and 16 in. mains. Of 3½ in. thickness, it is secured by heavy-gauge lacing-wire. The 12 in. pipe lines are lagged with 3 in. thick " Rocksil " flexible sections, with " Caposite " spacers.

" Noral 2SH " aluminium sheet, 0.036 in. thick has been used to give a protective finish to all insulated mains. Supplied by Alcan Industries Limited, in coil form, lengths are wrapped circumferentially round the mains, leaving a 2 in. overlap, and joined by " pop " rivets.

As the turbines are of the non-condensing type, there is no need for a circulating-water system at this station. Turbine auxiliaries, heat-exchangers and general services, however, require a small quantity of cooling-water and this is drawn from the River Derwent at the rate of about 470 gal./min. per turbo-generator set by two 85,000 gal./hr. pumps driven by 30 h.p. motors.

---

## DARLINGTON INSULATION CO. LTD.

The Darlington Insulation Co. Ltd. announces two new appointments which have been made in order to meet the needs of the company's continuing expansion. **Mr. S. Watson** has been appointed Northern regional manager, responsible for supervising and co-ordinating the work of the company's branches in the North of England and in Scotland. He will continue to operate from Vicarfield Place, Govan, Glasgow, S.W.1. **Mr. A. W. D. Pullar** has been appointed Southern regional manager, with similar responsibilities for the company's branches in the Midlands, South of England and Wales. He will continue to operate from 1087 Kingsbury Road, Tyburn, Birmingham, 24. The nation-wide insulation contracting activities of the company are carried on by branch organisations based on nine of the main industrial areas. The new appointments will ensure the continuation, as the company's activities expand, of the benefits secured by combining the local initiative, responsibility and knowledge of the nine area managers with progressive management and technical services from headquarters. Mr. Watson, who has been with the company for 22 years, has been Scottish manager since 1953. He is well-known in the North of England, having been North Eastern area manager from 1949 to 1953. Mr. Pullar, has also been with the company for 22 years. Since 1939, he has been responsible for developing and managing the company's activities in the Midlands, based on Birmingham.

* * *

It is with regret that we record the death, which occurred suddenly on December 24th, 1960, of **Mr. Arthur Cunningham,** managing director of Copes Regulators Limited. Mr. Cunningham, who was aged 64, had been with the company since its formation in 1928.

# The Superheater Company Limited

*Jubilees are occasions inviting appraisals of performance over the period commemorated. It is, therefore, with some gratification, that the Superheater Co. Ltd. can examine its record of development and progress over the last 50 years, and find it to have been one of most creditable achievement*

ON December 19th, 1960, The Superheater Company celebrated its Jubilee Year, embarking on a second half-century of highly-specialised but none the less wide service, in the design and manufacture of superheaters and associated equipment for power plant, marine and locomotive boilers of every type and size throughout the world. It has a history which will be of considerable interest to engineers, and its specialised products contribute greatly to the promotion of efficiency in every field of steam power production.

The company's head office is located in London, and its works are situated in Manchester's heavy industrial centre, Trafford Park, where the adjacent ship canal, nearby Merseyside ports, and direct connection with British Railways afford every facility for expeditious despatch of its products, nearly 40 per cent. of which are exported.

To the engineer, the significance of the superheater in any type of steam plant, with its essential contribution to efficiency, will be well-known but to others, the exact nature and purpose of the apparatus may not be fully understood. A word in explanation, therefore, will emphasise the full importance of the company's activities to all steam-using industries. The engineer, too, will appreciate that it is difficult, without assuming a thorough knowledge of thermo-dynamics, to explain the function of the superheater in a few words, but a simplified and more general explanation will be readily understood.

By addition of heat, water is converted into steam at a definite temperature which depends on the pressure, and at the point of collection the steam has the same temperature and pressure as the water in the boiler from which it is produced, it being termed " saturated " steam. In steam engines or steam turbines, a proportion of the heat energy in the steam is converted into mechanical energy by allowing the steam to expand to a lower pressure, and during this process, some of the steam will condense to water. If additional heat can be imparted to the steam before it reaches the engine or turbine, a greater proportion of its heat energy is available for conversion into useful work, whilst condensation is retarded. This can be achieved by passing the " saturated " steam leaving the boiler through a system of tubes arranged in the path of high temperature boiler flue gases so imparting additional heat or " superheat " to the steam without increasing the pressure. This apparatus is known as a " superheater," and the steam leaving it, at a temperature much above its

*(Above). View of the works of the Superheater Co. Ltd., at Trafford Park, Manchester, in 1914.*

*(Right). General view of the Trafford Park works at the present time. There are now 15 bays and the works extend over an area of 14 acres.*

" saturation temperature " is said to be " superheated." The heat consumption of all types of steam engines and steam turbines is greatly reduced when superheated steam is used, and their mechanical life is prolonged. The progressive increase in efficiency of steam power production, which has been achieved, would have been largely unobtainable without the employment of superheaters. Thus, whether for power station, marine, or locomotive application, the superheater, aptly referred to as the " heart of the boiler," is a vital component, and one which makes an outstanding contribution to fuel economy.

**History of the company**

Much has been accomplished by the Superheater Company in stimulating progress in the whole art of steam generation by improvements in design, construction and performance of steam superheaters, and a brief review of its history will confirm this. The company was founded in 1910, but those responsible for its inception had been, for some years previously, actively associated with Dr. Wilhelm Schmidt in the development of superheaters for locomotive and marine boilers, following his successful application of his apparatus in 1887 to a locomotive of the Prussian State Railways. As early as 1930, Trevithick, a pioneer of steam locomotive design, realised, to a limited extent, the advantage of superheating, and he and his contemporaries experimented with numerous devices to retard condensation in the steam plants of their day.

Later, in 1857, a German, named Hirn, investigated the problem more thoroughly than any of his predecessors, but it was the work of Wilhelm Schmidt of Kassel, Germany, towards the end of the 19th century, that constituted the real practical source from which the progressive development in steam superheater engineering took place. The Superheater Co. Ltd. is proud, therefore, that its history and activities have been so closely connected with the name of this great pioneer whose work and that of his associates, they have been privileged to carry on.

The company's association with Manchester dates from 1914 when the present works were established at Trafford Park. It is interesting to record that they stand on a site, which had only once previously been conveyed since being inscribed in the Domesday Book. During the first world war, the works were largely engaged on munitions work, but in 1919 the plant was enlarged, and machinery of a special design installed for the production of superheaters, employing a patented machine forging process, exclusively used for uniting the ends of lengths of tubes. By this process, " integrally forged returned bends " are formed, and superheater elements of various shapes built up, without the use of gas or electric welding. From that time onwards, large numbers of superheaters for both marine and locomotive boilers have been produced and exported to most parts of the world.

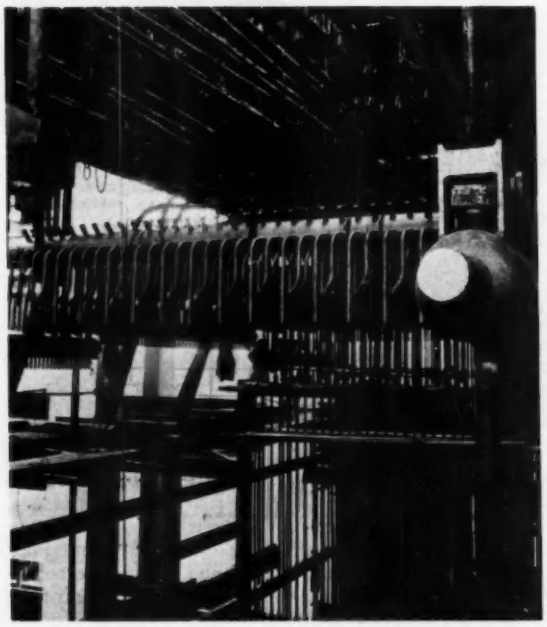
In 1925, the company's activities were extended to the industrial boiler field and it applied its specialised experience to the design and construction of superheaters for water-tube boilers. This necessitated further extensions to buildings and plant, so that in 1939 the works covered an area of four acres. During the war years, 1939-45, manufacture of locomotive marine and power plant superheaters was continued and constituted a vitally important contribution of high priority to the nation's war effort, an outstanding achievement being the construction of large numbers of superheaters for the Royal Navy in every class of vessel, from escort destroyers to battleships. At the conclusion of the second world war,

*(Above). The head office of the company in London, where the administrative, engineering, sales and service departments are situated.*

*(Left). The works of the company's subsidiary—The Superheater Company (Pty.) Ltd., Australia, at Yennora, near Sydney, N.S.W.*

further extension and reorganisation of the plant became necessary to meet the ever increasing demand for superheaters for all purposes at home and abroad. The works now extend over 16 acres, of which approximately 10 are covered, and equipped with the most modern machinery. They constitute the largest plant in the world devoted exclusively to the manufacture of superheaters and ancillary apparatus and equipment. There is a research department with a well-equipped physical, chemical and metallurgical laboratory, and also modern welfare facilities.

The business was carried on as a private limited company until 1938, when it became a public company, with an authorised capital of £450,000;—its present authorised capital is £1,600,000. The head office is at 97, Tottenham Court Road, London, W.1, where the administrative, engineering, sales and service departments are situated. In 1955, a subsidiary company—The Superheater Co. (Pty,) Ltd., Australia, acquired a factory site at Yennora, near Sydney, New South Wales, and established there a works equipped with the latest plant for the manufacture of superheaters, entirely devoted to satisfying the requirements of Australian industry. It is some indication of the demand for power



*MeLeSco superheaters and reheaters operating at a final steam pressure and temperature of 2,450 lb./sq. in and 1,060 deg. F., are installed with each of the five 1,400,000 lb./hr. International Combustion boilers at High Marnham power station.*

plant equipped with the company's products, that it has been found necessary to make a four-fold extension to these Australian works.

**Power plant**

The inauguration of the company's power plant department in 1925 was coincidental with the beginning of the upward trend in steam pressures and temperatures, and it is not surprising, therefore, that their wide experience in superheater engineering was soon in extensive demand by manufacturers and users of water-tube boilers. To a marked extent, development of the water-tube boiler over the past 30 years may be attributed to progress in superheater design and to the realisation that its requirements must be given precedence if the progressive demand for higher temperatures and improved performance were to be satisfied. In earlier boilers, the arrangement of the superheater was determined by conventional design; but as its significance and importance were realised, radical design changes took place. Today, the modern water-tube boiler is predominantly a combination of a large water-cooled furnace, a convection and a radiant superheater—with possibly a reheater, followed by an economiser, and an air-heater.

Progressive increases in operating steam temperature demanded that special attention be paid to the regulation of final steam temperature within close limits; and to achieve this, the MeLeSco inter-controlled superheater was developed,—the pioneer installation, the first of its kind in Europe, being at Fulham Power Station, London.

Whilst the company's power plant superheaters are designed for every class of user, and are installed in water-tube boilers of all well-known makes, the most advanced steam-generating practice is to be found in large electricity generating stations both at home and overseas. Here, for the Central Electricity Generating Board, and South of Scotland Electricity Board alone, MeLeSco superheaters are operating, or under construction at the present time in 469 boilers in 65 generating stations, and superheating over 45 per cent. of the total steam used in electricity generation.

Representative of the company's work in this vitally-important industry is the new High Marnham generating station in the East Midlands Division of the Central Electricity Generating Board, which, when complete, will be the largest thermal station in Europe. Here, of the five 200-MW boilers manufactured by International Combustion Limited, three, the first two of which are already in operation, will each evaporate 1,400,000 lb. of steam per hour, the MeLeSco superheaters and reheaters operating at a final steam pressure and temperature of 2,450 lb./sq. in. and 1,060 deg. F., with reheat to 1,005 deg. F.

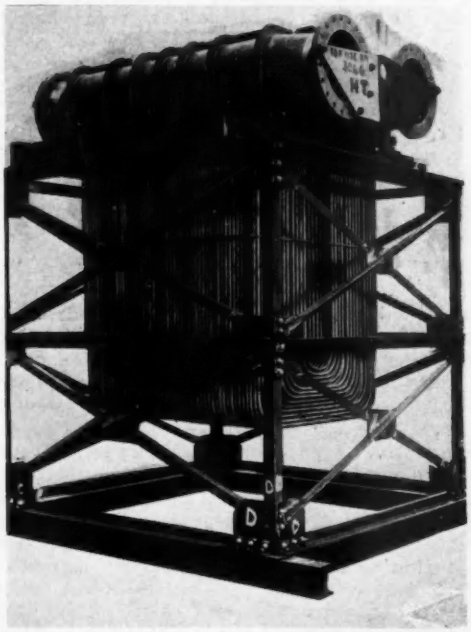
Work is proceeding on the construction of the superheaters and reheaters for the Yarrow boilers at Blyth "B" power station (C.E.G.B.), having an evaporative capacity of 1,900,000 lb./hr. and for the Clarke-Chapman boilers of 2,350,000 lb./hr., these boilers being associated with 275-MW and 350-MW turbo-alternators respectively, whilst at Thorpe Marsh power station, MeLeSco superheaters and reheaters will be installed in one of the largest boilers in the world—a 3,750,000 lb./hr. capacity controlled circulation unit operating at a pressure of 2,400 lb./sq. in. and which is being constructed by International Combustion Limited to supply steam at 2,300 lb./sq. in. and 1,050 deg. F., to a 550-MW re-heat generating set of two-shaft design, supplied by C. A. Parsons & Co. Ltd.

In recent years, even the largest boilers are required to be capable of two-shift operation. In order to facilitate this, and to meet the many special problems involved, the Superheater Company, after extensive research, has developed and manufactured "Acraspeed" and "Acramet" equipment for the critical supervisory

temperature measurement and control of boiler and associated plant installed in many of the major generating and industrial stations throughout the world.

**Marine**

Throughout the whole of the company's history, its marine department has been continuously engaged in the design and manufacture of superheaters for marine boilers of every type, and for all conditions of service; they are installed in merchant ships, from trawler to ocean liner. The company has supplied their well-known MeLeSco type of superheater to the Royal Navy in over 260 ships, equal, in fact, to 12,000,000 shaft h.p., these ships ranging from the Hunt class destroyers to



*Stainless steel and nimonic high temperature heat-exchanger manufactured by The Superheater Co. Ltd.*

the aircraft carriers *Eagle* and *Ark Royal*. Installations have been supplied to Cunard vessels, the T.S.S. *Carinthia*, and her three sister ships—two being fitted with Yarrow boilers and two with Foster Wheeler boilers. Many tankers have been supplied with MeLeSco superheaters, giving final steam temperatures of 800 deg. F. Bearing in mind the difficulties which can be experienced under seagoing conditions, the Superheater Company has always been foremost in the development of easily replaceable elements. As steam temperatures have increased, it has been necessary to employ welded joints; and in order to retain maintenance facilities, the "Melric" joint has been developed.

**Locomotive**

In the sphere of locomotive superheating, the company's influence and achievements have, throughout its history, been of a world-wide character, about 70 per cent. of its production being exported at the present time. Many thousands of locomotives have been equipped with MeLeSco superheaters, often incorporating the MeLeSco multiple-valve regulator, which, positioned in the smoke-box, offers definite advantage over former types of regulator. An example of this application is to be seen in British Railways' Standard Class 7 "Pacific" type 4-6-2 locomotives, the first of which was named *Britannia*. Another typical example of the company's many applications to locomotives on railways overseas is to be found in the Beyer-Garratt locomotives built for the New South Wales Government Railways by the century-old locomotive builders—Beyer, Peacock & Co. Ltd. of Gorton, Manchester. Weighing 255 tons, and having a tractive effort of 60,000 lb., these locomotives are the largest ever built in Europe.

**General**

In addition to their principal work of design and manufacture of superheaters, the company undertakes fabrication of economisers. It also designs and manufactures a wide range of special heat-exchanger apparatus for the nuclear, chemical and oil industries. More recently, the research department has devoted its attention to the field of feedwater heating, and designs have been produced for such equipment for some of the largest turbines now being built.

In many industrial processes, dry steam is an essential part of production, and the MeLeSco Helix steam dryer, designed and manufactured by the company, has found a wide application. This dryer is also widely used for the separation of water from air, and has been adopted by the Admiralty in H.M. submarines in connection with the "snort" system. Another example of its products, now being widely specified for modern power station plant, is the MeLeSco Salagraph, an apparatus for the measurement and continuous recording of impurities present in the steam leaving the boiler

The broad field in which the company's products are to be found is well illustrated by the company's ubiquitous trade mark, "MeLeSco," signifying its Marine, Locomotive and Stationary Superheater activities—and not unreasonably supports the claim as "The Authority on Superheated Steam."

---

**Mr. Harry West,** managing director, Associated Electrical Industries (Manchester) Limited, has been appointed to the board of Associated Electrical Industries Limited. In 1946, he was appointed assistant to the chief electrical engineer of the company; in 1949 he became chief electrical engineer, and was appointed to the M.V. board in 1951. Mr. West was associated with the A.E.I.-John Thompson Nuclear Energy Group from its inception, and when this was formed into a company he was the first chairman of its management committee. He ceased to be a director of electrical engineering when appointed assistant managing director at Manchester in January, 1960. He became managing director in April, 1960, succeeding Dr. C. Dannatt, who is now vice-chairman of A.E.I. Mr. West is also a director of The Nuclear Power Group; Metropolitan-Vickers-Beyer, Peacock Limited; Sunvic Controls Limited and Nucleonic Investments Limited.

* * *

Among contracts placed recently by the Central Electricity Generating Board, are the following. Two 350-MW turbo-generators, feed-heating plant, etc., for Blyth "B" power station (**English Electric Co. Ltd.**). High-pressure pipework and valves for No. 1 generating set, and for No. 1 boiler unit at Thorpe Marsh power station (**Aiton & Co. Ltd.**). For Drakelow "C" power station—circulating-water pumps (**Drysdale & Co. Ltd.**); coal-handling plant (**International Combustion Products Limited**); high-pressure pipework and valves for units 9 and 10 (**Babcock & Wilcox Limited**).

# POWER PLANT ENGINEERING

## during 1960

DURING 1960, the Central Electricity Generating Board installed a record amount of electricity generating plant—the total additional output capacity being 1,935-MW. Altogether 21 turbo-generator sets, with an aggregate installed generating capacity of 2,060-MW, which is some 285-MW up on the previous year's figure. As shown in the accompanying table, this new plant was installed in 14 power stations owned by the Board in England and Wales, four of them being new stations, in which plant was commissioned for the first time. New boiler plant consisted of 22 individual units, with an aggregate evaporative capacity of 15,890,000 lb./hr. of steam. It will be noted that in addition to the plant listed in the table, three boilers were completed but not commissioned, as the associated turbo-generator units are not yet available.

Of the generating units, two more of the ultimate five 200-MW sets were brought into service at High Marnham power station (East Midlands Division). This is the largest size of unit yet installed by the Board. The associated boiler has an output capacity of 1,400,000 lb./hr. of steam, and the turbine stop-valve conditions are 2,300 lb./sq. in., at 1,050 deg. F. Reheating is provided to 1,000 deg. F. after partial expansion of the steam through the turbine.

At Spondon "H" ("H" stands for heat) a new station adjoining the existing 172-MW Spondon "A" station, Nos. 2 and 3 back-pressure sets, each of 10-MW capacity, and No. 4 boiler (180,000 lb./hr. capacity) were commissioned during the year. The station, details of which are given elsewhere in this issue, supplies approximately 450,000 lb./hr. for process requirements to the nearby factory of Courtaulds Limited.

The annual report of the C.E.G.B. for the year ended March 31st, 1960, refers to the continued progress in the design and development of thermal power generating plant. As a result of this progress, orders have been placed for 275-MW, 300-MW, 350-MW and 550-MW generating sets. The last mentioned machine involves a two-shaft design, and all the units above mentioned are designed for steam conditions of 2,350 lb./sq. in. and 1,050 deg. F., with reheat to 1,050 deg. F. Orders have recently been placed for two 375-MW generating units to operate at a super-critical steam pressure of 3,500 lb./sq. in., and a temperature of 1,100 deg. F., with 1,050 deg. F. reheat.

### Manufacturers' progress

#### THE ENGLISH ELECTRIC CO. LTD.

As regards atomic power plant, the consortium of the English Electric, Babcock & Wilcox and Taylor Woodrow Atomic Power Construction Co. Ltd. has been entrusted by the Central Electricity Generating Board with a second order for a large civil atomic power station, viz., Sizewell, on the coast of Suffolk. As mentioned in the January issue of this journal, the station will have an electrical output of 580-MW, thus making it the seventh and the largest to date of the United Kingdom's atomic power stations. Although steam pressure and temperature conditions at Sizewell will be low compared with those for modern conventional thermal stations, the turbo-alternator sets will embody the most up-to-date develop-

BOILER AND STEAM POWER GENERATING PLANT COMMISSIONED BY C.E.G.B. DURING 1960

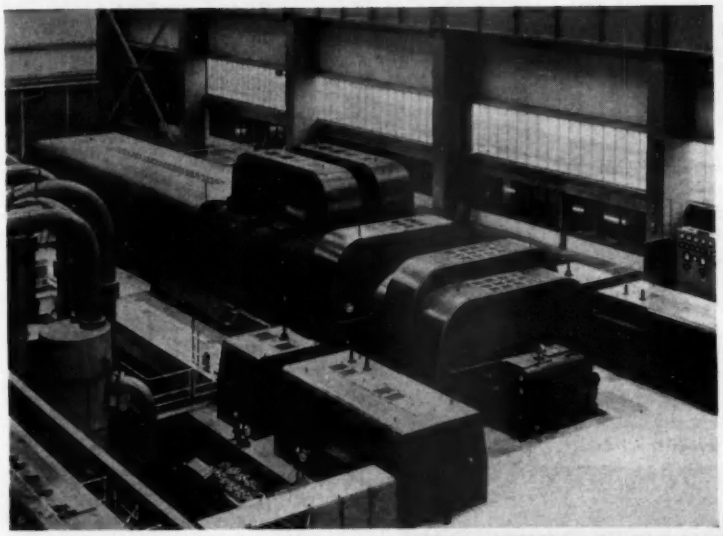
| Name of Power Station | C.E.G.B. Project Group | Turbo-Generator Plant | | Boiler Plant | |
|---|---|---|---|---|---|
| | | Installed capacity (MW) | Maker | Capacity in lb./hr. | Maker |
| *Steam Plant* | | | | | |
| Aberthaw* | Midlands | 2 x 100 | C. A. Parsons & Co. Ltd. | 2 x 755,000 | Foster Wheeler Ltd. |
| Agecroft "C" | Northern | 1 x 120 | Associated Electrical Industries Ltd. | 1 x 860,000 | International Combustion Ltd. |
| Belvedere L.P. | Southern | 1 x 60 | English Electric Co. Ltd. | 1 x 550,000 | John Brown Land Boilers Ltd. |
| Blyth "A" | Northern | 1 x 120 | Associated Electrical Industries Ltd. | 1 x 860,000 | Babcock & Wilcox Ltd. |
| Bold "B" | Northern | 1 x 60 | General Electric Co. Ltd. | 1 x 550,000 | John Thompson Ltd. |
| Drakelow "B" | Midlands | 2 x 120 | C. A. Parsons & Co. Ltd. | 2 x 860,000 | Foster Wheeler Ltd. |
| Elland | Northern | 1 x 60 | Associated Electrical Industries Ltd. | 1 x 550,000 | John Brown Land Boilers Ltd. |
| High Marnham | Midlands/Northern | 2 x 200 | English Electric Co. Ltd. | 2 x 1,400,000 | International Combustion Ltd. |
| Northfleet* | Southern | 3 x 120 | General Electric Co. Ltd. | 3 x 860,000 | Foster Wheeler Ltd. |
| Plymouth "B" H.P.† | Southern | 2 x 60 | Associated Electrical Industries Ltd. | 2 x 550,000 | Babcock & Wilcox Ltd. |
| Skelton Grange "B" | Northern | 1 x 120 | C. A. Parsons & Co. Ltd. | 1 x 860,000 | Mitchell Engineering Ltd. |
| South Denes | Southern | 1 x 60 | Richardsons Westgarth Ltd. | 1 x 550,000 | Mitchell Engineering Ltd. |
| Spondon "H" | Midlands | 2 x 10 | Associated Electrical Industries Ltd. | 3 x 180,000 | Foster Wheeler Ltd. |
| Staythorpe "B" | Midlands | 1 x 120 | Associated Electrical Industries Ltd. | 1 x 860,000 | John Brown Land Boilers Ltd. |
| 14 Stations including 4 New Stations and 1 New Section | 3 Project Groups | 21 Turbo-generators having an aggregate installed capacity of 2,060-MW | | 22 Boilers having an aggregate installed capacity of 15,890,000 lb./hr. | |

In addition to the above, the following boilers have been completed but not commissioned as associated turbo-generators are not yet available :—Belvedere H.P.—Boiler No. 5—960,000 lb./hr. capacity, manufactured by John Brown Land Boilers Ltd. Rugeley—Boiler No. 1—860,000 lb./hr. capacity, manufactured by Babcock & Wilcox Ltd.

NOTES:—The Power Stations marked thus (*) are new stations in which plant has been commissioned for the first time in 1960, and the station marked thus (†) is a new section. The remainder are existing stations to which extensions have been made.

ments. Only two turbo-alternators, each rated at 325-MW capacity at a vacuum of 29 in. Hg. are to be installed, thus considerably reducing the requisite side of the turbine house. Each turbine will be a 3,000 r.p.m. in-line tandem compound machine, employing the largest l.p. exhaust blades to be manufactured. The turbines are to be mixed-pressure machines, and one of the novel features will be the use of bled steam to reduce exhaust wetness. The h.p. cylinder will use steam at 646 lb./sq. in. and 700 deg. F., the l.p. cylinder taking steam at 253 lb./sq. in. and 700 deg. F. Sizewell, which is scheduled for operation, brings the country's atomic power capacity now under construction to 3,000-MW, of which the English Electric, Babcock & Wilcox and Taylor Woodrow consortium is supplying more than one-third.

In the small reactor field "English Electric" continued its collaboration with the American company, Atomics International, on organic moderated reactors. Training of "English Electric" engineers with Atomics International in California is continuing. Overseas, the company has not relaxed its efforts to interest other countries in atomic power. Negotiations in both large and small reactor fields on the commercial and technical fronts have taken place in a number of European countries.

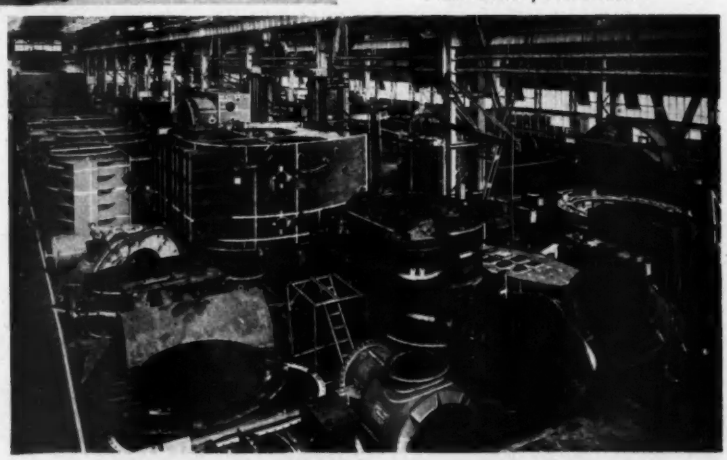


*(Left). Turbine house interior at C.E.G.B. High Marnham power station, showing one of the five "English Electric" turbo-alternator sets which operate with steam conditions of 2,350 lb./sq. in., and 1,050 deg. F., and reheat to 1,000 deg. F.*

**Steam turbines**

The year 1960 has witnessed an increasing trend towards large steam turbo-alternator sets of advanced design, especially of the single-line type, for use on the large interconnected systems in Great Britain and overseas. Of the orders placed with The English Electric Company by the Central Electricity Generating Board during 1960, undoubtedly the contract for Britain's first 375-MW supercritical machine marks an important stage in the development of the modern steam turbine. This 375-MW, 3,000 r.p.m. set, ordered by the Central Electricity Generating Board for Drakelow "C" station (East Midlands Division), is to be a single-line tandem machine. The turbine will operate with steam at the advanced steam pressure of 3,500 lb./sq. in., and 1,100 deg. F., reheat to 1,050 deg. F., with a vacuum of 28.7 in. Hg. The alternator will have a water-cooled stator and a hydrogen-cooled rotor and will generate at 19,000 V. Another important contract awarded to the company by the Central Electricity Generating Board was for two 350-MW units for Blyth "B" power station. These are similar to the two machines previously ordered for the Board's Drakelow "C" station. Running at 3,000 r.p.m., the turbines will operate with a vacuum of 29.0 in. Hg. The alternators will be of the direct-cooled type, also employing a water-cooled stator and a hydrogen-cooled rotor, the gas pressure being 45 lb./sq. in. g. Generation will be at 19,500 V.

An outstanding overseas order received by the company during the year was that for a third 200-MW reheat unit for Vales Point, Australia. These 200-MW turbo-alternators still represent the largest units being supplied

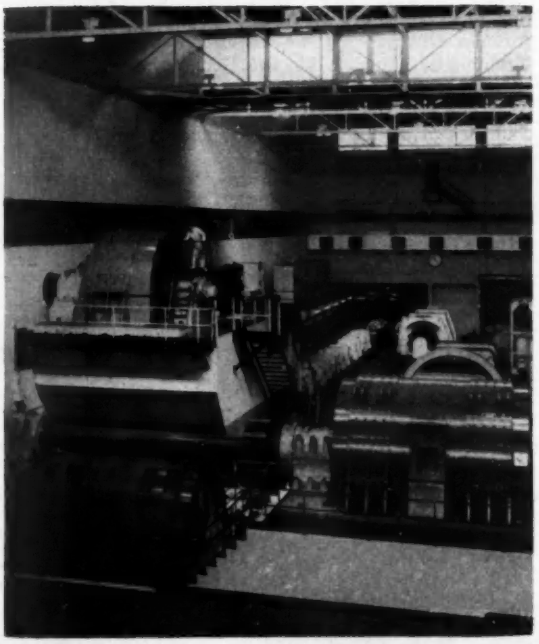


*(Below). Condenser assembly shop at The English Electric Company's Netherton Works, showing condensers being machined and assembled for High Marnham, and for Hinkley Point nuclear power station.*

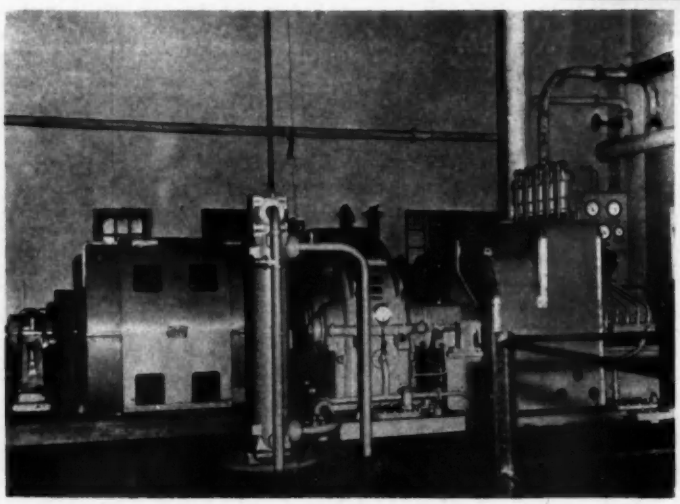
to the Southern Hemisphere, and will be installed in Australia's largest projected station. They will operate at 3,000 r.p.m., steam conditions 2,350 lb./sq. in. and 1,050 deg. F., with reheat to 1,000 deg. F., and exhaust to 28.4 in. Hg. vacuum. The alternators are of the fully direct hydrogen-cooled type, generating at 16,500 V with a rated gas pressure of 30 lb./sq. in g. Other repeat orders from abroad include a second 30-MW set for Hex River power station in South Africa.

Commissionings during the year also reflected the trend towards larger units. Of the units commissioned by "English Electric" for the Central Electricity Generating Board, it is significant that only one 60-MW set was included. The biggest machine commissioned was the second 200-MW set at High Marnham. The 60-MW unit was the fourth "English Electric" turbo-alternator set to be installed at Belvedere. Smaller sets commissioned during 1960 include the second 30-MW machine at the Coolkeeragh power station of the Electricity Board for Northern Ireland. Three 6,500-kW sets were commissioned for South Durham Steel & Iron Co. Ltd., West Hartlepool Works, thus totalling, in all, 11 "English Electric" machines in operation at this company's works. The twelfth set, ordered during 1960, is a 10,400-kW unit for the West Hartlepool Works. "English Electric" sets commissioned throughout the world included the first 100-MW set for Australia, which was supplied to the Electricity Commission of New South Wales for their Tallawarra power station. A second set is now in course of erection. Also commissioned in Australia was the first of two 60-MW sets for the Playford "B" power station (formerly Port Augusta) of the Electricity Trust of South Australia. A third 30-MW set, together with boiler plant and all ancillary equipment, was commissioned for the Hong Kong Electric Co. Ltd., at their North Point "B" power station. Work continued during the year on the contracts for the 10-MW set at the Burri power station extension, Khartoum, and the first 25-MW set at Grand Pass, Colombo.

In the smaller high-speed range of steam turbines, an important contract awarded to the company was for four 6,000-kW back-pressure sets. These machines, which run at 7,000 r.p.m., geared to 1,500 r.p.m. alternators, are to supply power and process steam for beet sugar factories in Russia. Further orders from abroad include a 3,000-kW set for South West Africa, 1,875-kW and 1,250-kW sets for India and a 1,325-kW set for Egypt. The company has also obtained a contract for a high-speed condensing turbine rated at 6,470-kW. This machine, which runs at 6,500 r.p.m. direct-coupled to an axial-compressor, is being supplied for the largest tonnage oxygen plant in Europe. High-speed machines commissioned during 1960 include 1,500-kW sets at sugar mills in the Philippines and Kenya, and a 5,000-kW set for the National Coal Board. Two 1,030 h.p. turbines running at 10,000 r.p.m. driving compressors at 600 r.p.m. and two 2,300-kW turbines running at 8,500 r.p.m. were also commissioned for the South Eastern Gas Board.



*(Above). The 4,000 h.p. edger motor recently installed at the Abbey Works, Margam, of the Steel Company of Wales, shown mounted above the twin-drive motors for a 45 in. slabbing mill originally supplied by "English Electric."*



*(Left). An English Electric 1,500 kW 8,000/1,500 r.p.m. geared back-pressure turbo-alternator set at Miwani Sugar Mills (Kenya). This set provides 50,000 lb./hr. of process steam at 10 lb./sq. in.*

**Gas turbines**

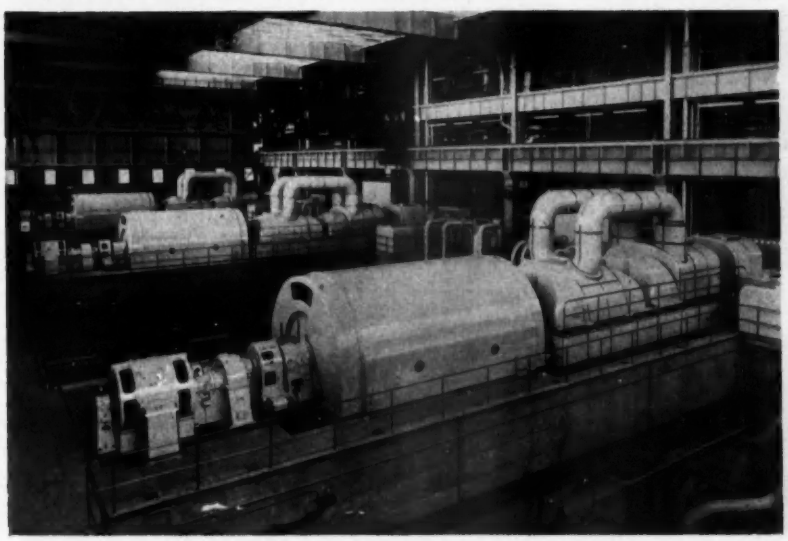
The first "English Electric" 8,000 h.p. EM85 gas turbine at present being commissioned on site is one of three units ordered by the Iraq Petroleum Co. Ltd., for installation at Kirkuk. These units will form a major part of an oilfield pressurisation scheme as prime movers for multi-stage centrifugal water-pumps. The second and third sets have also passed their works acceptance tests, and are now being shipped to site. Four similar units are being supplied to the Basrah Petroleum Company for installation at Fao, where they will form part of a tanker loading terminal project. The first set is largely completed. These machines will drive crude-oil transfer-pumps. During the year, gas-turbines of the smaller EM27 type were commissioned in the U.K., Canada and British North Borneo. The latter is a 1,770-kW geared turbine and alternator set installed for the Shell Petroleum Company at Lutong, for base-load running on natural gas. It has previously completed proving trials at Stanlow refinery in Cheshire. The gas turbo-alternator set installed at Alberta University, Canada, is now being operated by the authorities as a valuable contribution towards the reduction of power and heating costs. Other units of this type are currently being installed at power stations in Indonesia and India, where the company is equipping the first industrial gas-turbine power station at Saloni, Assam, for Oil India (Private) Limited. The station was originally intended to contain two EM27 1,790-kW gas turbo-generating sets, operating on natural gas, but confirmation of an order for a third set to be installed in the same station was received during the early part of the year.

**Large industrial drives**

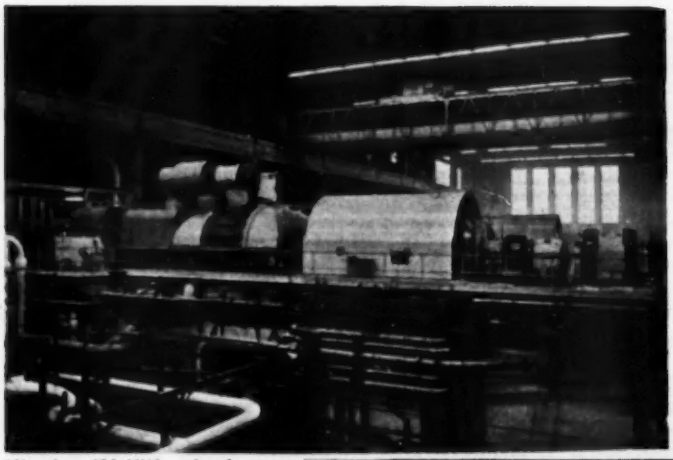
"English Electric" activities in the field of general industrial drives in 1960 have included contracts for power station auxiliaries, test-rig drives, and other industrial installations such as drives for food factories, chemical works, pumps and compressors. Amongst the notable orders received for power station auxiliaries drives was one for Thorpe Marsh power station, for which two boiler feed pumps and three booster pump motors, and associated liquid controllers are to be supplied. The boiler feed pump motors are of the variable-speed slip-ring induction type rated at 8,400 b.h.p., 1,000 r.p.m., and the booster pump motors are squirrel cage, induction type rated at 3,550 b.h.p., 3,000 r.p.m. When installed, these motors will be amongst the largest employed for this duty in Great Britain. During the year two further sinter fan installations have been commissioned, one at Workington Iron & Steel Co. Ltd., and the other at John Lysaghts, Scunthorpe. In both cases, the main fan motors have been supplied together with drives for one preparation and mixing plant. The fan motors are rated for outputs of 2,750 h.p., each at Lysaghts, and 2,000 h.p. each at Workington. Apart from the items mentioned, many orders have been received for alternators, driven by gas-turbines, oil engines, and geared steam turbines, and the specialised drives required for such process industries as rubber and sugar.

*C. A. PARSONS & CO. LTD.*

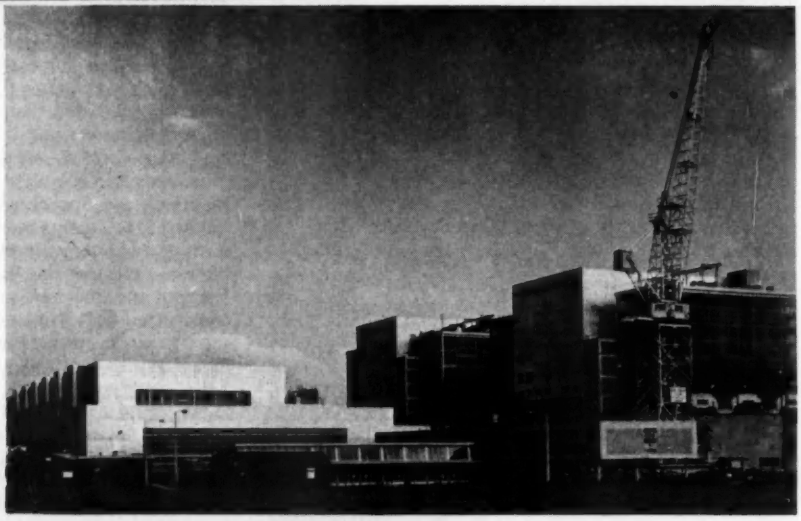
Contracts received by this company during the year are for turbo-generators and turbo-blowers, and also for the turbines and associated equipment for one of the latest nuclear power stations in this country. One of the contracts, placed earlier in the year, is for three turbo-blowers complete with condensing plant and auxiliaries, and two 10-MW single-cylinder "pass-out" turbo-generators also complete with condensers and auxiliaries, for the new Spencer Works of Richard Thomas & Baldwins, at Llanwern, Newport, where the new works form part of a large development scheme by R.T.B. The blowers will be the largest blast-furnace blowers in Europe, and the first modern axial-flow blowers to be constructed by a British manufacturer. Each will deliver 170,000 cu. ft./min. of free air, at 45 lb./sq. in. pressure. The turbines for these units require an output of 23,550 b.h.p. and will operate with steam conditions of 625 lb./sq. in. at 830 deg. F. Each is of the single-cylinder pure-reaction type. The turbines for the two 10-MW turbo-generators are of the single-cylinder type designed for similar steam conditions as the turbines for the blowers, but arranged for passing out steam from a



*Three 120-MW turbo-alternator sets, supplied together with associated condensing and feed heating plant by C. A. Parsons & Co. Ltd. and installed at the Kincardine power station of the South of Scotland Electricity Board. Turbine stop-valve steam conditions are 1,500 lb./sq. in. and 1,000 deg. F., with reheat to 1,000 deg. F.*



*(Above). 120-MW turbo-alternator set supplied by C. A. Parsons & Co. Ltd. nearing completion at Skelton Grange " B " power station.*



*(Right). General view of Bradwell nuclear power station which is now nearing completion.*

*(Below). Turbine house at Bradwell showing five of the six 52-MW turbo-alternator sets supplied by C. A. Parsons & Co. Ltd.*

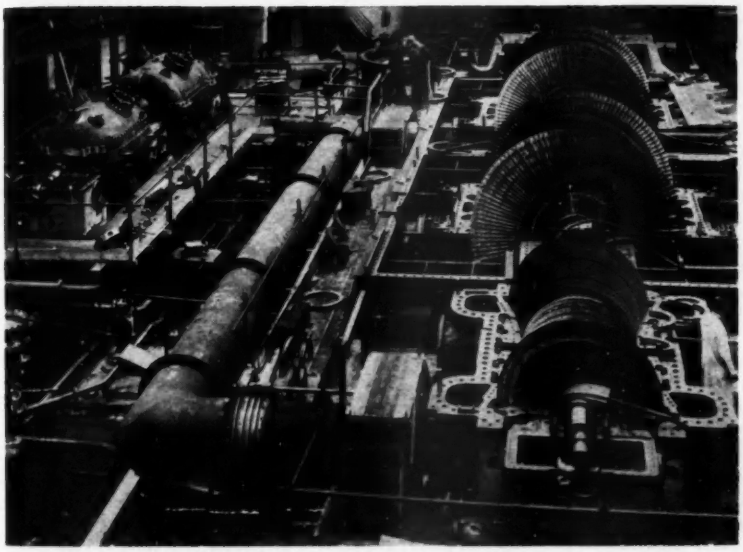
single-pressure point at 170 lb./sq. in. Other turbo-generators have been ordered for power stations in this country, and for export to Canada, Eire and Nigeria.

A considerable number of turbo-generators, with an aggregate output of 1,726.8-MW were placed in commission during the year. More than half of these are installed in power stations overseas, and the remainder in power stations in the United Kingdom. Amongst the larger sets commissioned, were two of 100-MW capacity and five of 120-MW capacity in the United Kingdom. Both the 100-MW sets were the first two of four for installation at Aberthaw power station, C.E.G.B. (South Wales Division) whilst the 120-MW sets were: the third at Kincardine (South of Scotland Electricity Board), the first at Skelton Grange " B " (Yorkshire Division), machines Nos. 7 and 8 at Drakelow " B " (East Midlands Division), and the first at Rugeley power station (East Midlands Division).

An industrial machine of 4,000-kW capacity was also commissioned for the Darwen and Mostyn Iron Company, Flintshire, North Wales. The first of two 300-MW cross-compound machines for Canada has been completed and despatched to site. Both these machines were ordered by the Hydro-Electric Power Commission of Ontario for their power station at Lakeview, near Toronto. Other machines of 200-MW capacity were put into commercial service at the Richard L. Hearn Generating

Station, Toronto, these being the last of four similar machines for the extensions to this station. These 200-MW sets bring the installed generating capacity at the station up to 1,200-MW making it the largest station in the world where all the sets were made by one manufacturer. Four other machines have been commissioned in Canada—one a 66-MW set at Boundary Dam power station, two similar sized sets at Selkirk power station, and the fourth, a 10-MW set at Charlottetown.

In Australia, the last of three 60-MW sets have been put into commercial service at Wangi power station, as has a 30-MW set at Bunbury, and the last of two 15-MW sets at Muswellbrook power station, N.S.W. Three machines have been completed in Nigeria—two 30-MW sets in the Ijora " B " power station, and the first of two 10-MW sets in the Oji River power station. In Mexico, two machines, each of 25-MW output, were completed and put into commercial service at Monterrey, whilst other machines of 20-MW and 15-MW capacity have been commissioned in Trinidad and Jamaica. The 20-MW machine is the second of three such machines at Penal power station, and the 15-MW machine is the last of two machines in Hunts Bay power station, Kingston.



*300-MW cross-compound turbo-alternator set for Lakeview power station, Canada, during erection for test purposes at the Heaton Works of C. A. Parsons & Co. Ltd.*

**Nuclear power plant**

The C.E.G.B. have placed the contract with The Nuclear Power Group for plant for Dungeness nuclear power station—the sixth commercial nuclear power station in Britain. Work commenced on the site during August last, and the station, which is due for completion in 1964, is designed for a nett electrical output of 550-MW. There will be two identical reactor units of approximately 840-MW thermal output each, together with the usual auxiliaries. The four 142.5-MW main turbines will be constructed at the company's Heaton Works, together with four sets of feed-heating plant, two dump condensers, and all the high-pressure and low-pressure steam and feed piping and valves. Bellows units for the $CO_2$ duct-work will also be constructed, together with flux scanning and thermocouple elements. At the Chapelcross station of the United Kingdom Atomic Energy Authority, the last two machines were put into commission during the earlier part of the year. Work at the C.E.G.B. Bradwell is proceeding and it is anticipated that the first plant in the station will be commissioned this year. There will eventually be six dual pressure 3000 r.p.m. turbo-generator sets each of 52-MW capacity.

---

LARGEST GENERATING UNIT IN SOUTHERN HEMISPHERE

Orders worth £3 million have been obtained by **Associated Electrical Industries Limited,** in Australia. They include the largest thermal generating unit ever ordered for service in the southern hemisphere, and transformers which will operate on the highest system voltage in Australia. These orders have been placed by the Electricity Commission of New South Wales. The generating unit (worth approximately £2 million) is for a power station at Vales Point, about 70 miles north of Sydney. The unit will have an output of 275-MW, and will comprise a reheat turbine and a hydrogen-cooled generator. Stator windings for the generator will be water-cooled—a technique pioneered by A.E.I. and first put into service in 1956. The other contract is for 13 transformers worth £1 million; seven of these will be rated 133-MVA and will operate at 330-kV—the highest system voltage in Australia. The other six are rated 60-MVA at 132-kV. The generating unit, due for commissioning in 1965, will be made at the company's Trafford Park Works, Manchester, and the transformers at Rugby. A.E.I. Limited has previously undertaken many important contracts in Australia. Two 200-MW sets, which are being installed at Hazelwood, incorporate the water-cooling technique. Other generating sets, ranging from 25-MW to 50-MW, have been supplied for Yallourn, Kiewa, South Fremantle, Wallerawang, Tallawarra, Morewell Briquetting Works and Pyrmont " B " stations respectively. A machine generating 120-MW is due for commissioning at Yallourn in March next, and a second and similar unit is under construction, at Trafford Park. A.E.I. is also supplying two 60-MW generators for the important power station being built at the foot of the Eildon Dam in Victoria. The Vales Point turbine will be rated at 275-MW, 3,000 r.p.m., with steam at a stop-valve pressure of 2,300 lb./sq. in. at a temperature of 1,050 deg. F., and exhausting against a back-pressure of 2 in. Hg. absolute, with cooling water at 75 deg. F. It will be of the four-cylinder type, and will be designed for seven-stage feed-heating to a final feed temperature of 485 deg. F. It will be direct-coupled to the a.c. generator which will be rated at 305.555-MVA, 9 p.f., three-phase 50 c/s 16.5-kV.

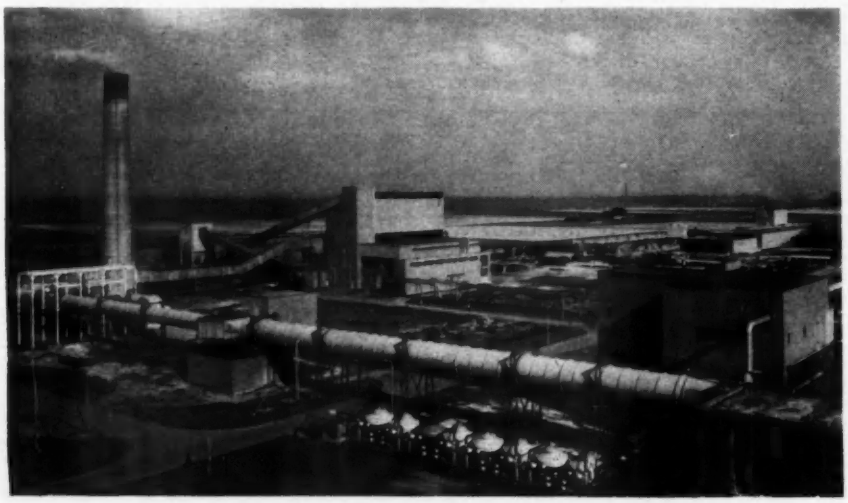
# Steam and Power Plant at a Fibre Factory

AN interesting example of a modern industrial process steam and power plant is that now in operation at the Grimsby establishment of Courtaulds Limited, which is engaged in the manufacture of fibres. There are two large production units on the site, one plant producing rayon staple fibre, and the other the modern acrylic fibre known as "Courtell." Both processes are essentially continuous, and unplanned stoppages would result in serious financial losses, not only on account of the amount of production lost, but also through both the trouble and time involved before first quality yarn could be again produced. In the rayon plant, one part of the process is known as an ageing cycle in which complete reliability of steam and power supplies is essential. The boiler plant was planned and designed with this requirement in mind, and the question of boiler availability of the boiler plant was also very strictly specified.

In keeping with the rest of the production equipment, the boiler plant is an outstanding example of a medium-sized industrial steam generating installation, incorporating most of the best features in modern practice relating to coal-handling, firing, and ash-removal. The plant is provided with fully-automatic control equipment and is comprehensively instrumented. Great importance has been laid on the question of cleanliness, with the result that no trouble whatsoever has been experienced with the turbines, which are located on the same common floor as are the boilers. Two Brown-Boveri turbo-generator sets are installed, each being of the pass-out condensing type, and rated at 4,000-kW. These two machines supply all the necessary electricity to the works, and are combined extraction/condensing sets in which up to 25,000 lb./hr. of steam can be condensed; the minimum quantity of extraction being 4,500 lb./hr. The turbines are designed to receive steam at 680 deg. F., and they operate at 3,000 r.p.m., giving an 11,000 V supply at three-phase, 50 c/s. Steam conditions at the stop-valve are 350 lb./sq. in. and 680 deg. F., with a pass-out pressure of 25 lb./sq. in. The relatively low stop-valve steam conditions are entirely suitable for the steam cycle requirements on the staple fibre plant. To cater for possible future site development, and extensions to the manufacturing plant already authorised, equipment is on order which includes a larger boiler to operate at a pressure of 900 lb./sq. in. and also a back-pressure pass-out turbine of 6-MW capacity.

**Coal-handling plant**

The coal-handling belt-conveyor plant was supplied by John Thompson Limited, and is capable of transporting 60 tons/hr. of coal. The receiving point is so arranged that coal from either road lorries or railway wagons can be dealt with. The rotary wagon-tippler empties into the hopper which discharges by means of a variable-controlled vibratory-feeder on to the first 350 ft.-long by 24 in.-wide conveyor belt. On the conveyor the coal, which consists of 1-in. dry "smalls" from either the East Midlands or South Yorkshire coal fields, is mixed with gas-coke fines in the proportions of 80-20 per cent. From this conveyor, the "mixed" fuel drops on to a second conveyor of the same width but 534 ft. long; finally, the mixture is transferred to a distribution belt above the bunkers serving each of the three boilers. Fuel can also be delivered directly from the first belt to a small coal-storage area. The speed of all belts is 240 ft./min. and the controls are so arranged that the end conveyor always starts up first in order to avoid any pile-up when loading commences. At the present time, coal consumption is approximately 1,200 tons per week; but when the fibre manufacturing plant is in full production, this weekly figure for coal consumption is expected to rise to something of the order of 1,700 tons.



*Part of the site at Grimsby, showing, in the centre, the combined boiler and turbine house which contains the three 70,000 lb./hr. boilers supplied by John Thompson Limited, and the two 4,000-kW Brown-Boveri pass-out sets of the condensing type.*

**Boiler plant**

The boiler plant comprises three John Thompson bi-drum water-tube units with water-cooled furnaces, each rated at 70,000 lb./hr. at m.c.r. with an e.c.r. of 55,000 lb./hr. at a pressure of 365 lb./sq. in. Each boiler has a heating surface of 18,125 sq. ft. and is fitted with a John Thompson pendant-type integral superheater of 2,800 sq. ft. heating surface. The design temperature of the steam at the superheater outlet is 700 deg. F. and, after leaving the superheater, the steam can be passed through the non-contact type attemperator. Feedwater at 220 to 250 deg. F. enters each of the three economisers which are Premier Diamond "Type 25" supplied by E. Green & Sons Ltd. Each economiser consists of 220 tubes each 12 ft. long, and has a heating surface of 15,390 sq. ft. Each boiler is fitted with a Class "L" louvre-type travelling-grate stoker supplied by International Combustion Limited. The effective grate area of each stoker 340 sq. ft., and speed control equipment giving a speed range between 20 and 60 ft./hr. is provided.

The draught plant and grit-arresting equipment was supplied by James Howden & Co. Ltd. Each double-inlet Turbovane-type induced-draught fan is capable of handling up to 56,300 cu. ft./min. of outlet flue gases at a temperature of approximately 325 deg. F., and is driven by a 117 b.h.p. motor at 730 r.p.m. through a Vulcan-Sinclair variable-speed fluid coupling. These couplings, which were supplied by Fluidrive Engineering Co. Ltd., are size 29 SCR4 units giving speed variation from 710 to 150 r.p.m. Grit-arresters are incorporated in the inlet scrolls of the induced-draught fans. Combustion-air for each boiler is provided by a Howden single-inlet forced-draught fan, capable of delivering up to 35,600 cu. ft./min. of air at a pressure of approximately 4 in. w.g. Each of the three F.D. fans is driven by a 37 b.h.p. motor running at 730 r.p.m., also through fluid couplings (size SCR4) supplied by Fluidrive Engineering Co. Ltd., and giving the same speed range (710 to 150 r.p.m. as the couplings on the I.D. fans. Secondary air is supplied by a Howden type-"P" fan driven by a 22 b.h.p. motor running at 1,440 r.p.m. and delivering up to 6,300 cu. ft./min. of air at pressures up to 14 in. w.g. The boiler furnaces are each fitted with single-nozzle retractable sootblowers supplied by Hopkinsons Limited, Huddersfield, and these operate at full boiler steam-pressure; soot-blowers for the superheater are of Hopkinsons "multi-port" design. Feedwater can be supplied to all three boilers under normal conditions by a G. & J. Weir Limited five-stage electrically-driven feed pump of 200,000 lb./hr. capacity, at a pressure of 500 lb./sq. in. In the event of failure of this pump, an automatic switch sets in operation a two-stage steam turbine-driven pump.

**Automatic control**

A comprehensive system of instrumentation and automatic control equipment has been provided by Electroflo Meters Co. Ltd. The speed of the F.D. fan and the stoker grate-speed are both controlled in accordance with steam pressure, which naturally reflects steam demand. A separate controller maintains constant furnace-pressure by controlling the I.D. fan coupling, as the F.D. fan and grate-speed vary, while the overfire secondary-air supply is adjusted manually to suit the prevailing combustion conditions. Facilities are also provided for (a) distributing the load between the three boilers, (b) adjustment of fuel/air ratio, and (c) the remote and local manual control of all variables, independent of the master controller, if required.

*(Left). The boiler firing aisle showing the fronts of the Class "L" stokers supplied by International Combustion Limited.*

*(Below). The combined boiler and turbine house with the two 4,000-kW Brown-Boveri sets in the right foreground, and (left) part of the boiler plant.*

**Ash-handling plant**

A comprehensive ash-handling system is installed in the boilerhouse basement. All coarse ash is discharged from the boilers through a paddle-box system connected

to each boiler, and transferred from there to a "dry system" horizontal belt, 290 ft. long, and 30 in. wide, travelling at a speed of 33 ft./min. From this belt, the ash and dust is discharged on to an inclined belt 445 ft. long, and 24 in. wide, operating at 50 ft./min. All grit is removed from the flue-gas system and transferred to the common belt by means of Redler conveyors. The entire amount of boiler ash and dust is finally discharged into a large-capacity concrete storage-hopper located outside the boiler house, and from this hopper it is removed from the site for disposal, by road vehicles.

**Ancillary equipment.**

All the boiler valves and mountings were supplied by Hopkinsons Limited. The safety-valves on the boiler drums are designed to give a maximum relief-pressure of 430 lb./sq. in. and those on the superheaters 385 lb./sq. in. The deaerators, manufactured by G. & J. Weir Limited, are of the "Optimum No. 4" size, designed for a duty of 250,000 lb./hr., and an outlet temperature of 220 deg. F. to 250 deg. F. Each deaerator pump is driven by a 16 h.p. motor running at 1,440 r.p.m.

The boiler supporting steelwork was supplied and erected by Edward Wood Limited, Manchester; while all ducting, flues, galleries and ladders were supplied by John Thompson Limited. Indicative of the thought which has been given to general power house cleanliness, is the provision of a permanent vacuum cleaning plant installed by the British Vacuum Cleaner and Engineering Co. Ltd., and taking the form of a ring bus-line throughout the boiler house. Apart from general cleaning as a daily routine duty, this system is invaluable for maintenance purposes when periodically the boilers are cleaned internally. Dirt, dust and general inconvenience normally associated with this operation are reduced to a minimum.

**Efficiency**

Under official test conditions it was determined that the gross boiler plant efficiency was 82.5 per cent. and the gross thermal efficiency of the actual boiler units when fired with fuel of the gross calorific value was 84.5 per cent. The guarantee of 4,000 hours' continuous steaming on East Midlands dry slack at m.c.r. was fulfilled without difficulty, and 8,000 hours now seems possible at the same rating.

This complete boiler and power plant is undoubtedly an excellent example of a modern industrial coal-fired installation, using suitably-blended fuel, and obtaining good thermal efficiency, with virtually complete automatic operation, and conditions of extreme cleanliness.

# Spirax Postal Instruction Courses

During the second world-war, **Spirax-Sarco** engineers worked voluntarily for the Ministry of Power—helping to conserve the nation's fuel supplies. It became abundantly clear to the company that, whereas there were experts in plenty who were familiar with the generation of steam and heat, there were few who knew how to use either to the best advantage. Little if anything had been written and published on the subject, and it was not, perhaps, surprising therefore that it was seldom taught in technical colleges. It was in order to make some modest contribution to filling this gap that the company introduced and offered in 1944, free and without any obligation, three postal courses—elementary and advanced, concerning steam for process and heating, certain aspects of steam for power, and what is known as the "ABC of Temperature Control." The immediate response by steam users confirmed the value of the idea. Immediately after the war, when the Spirax company started to build up what is now a large and developing export business, it was found that the demand for this technical information overseas was even greater. It was thought essential that these courses should be freely available to all steam users who thought they could profitably use them. They were to be a specific and objective service, and in no way to be confused with the company's other more detailed technical or commercial publications. The offer of these courses was made through the technical and national press, in the company's bi-monthly technical review entitled "Topics" (founded three years before, and now circulated in nine editions throughout the world), by the company's regional engineers at home, and U.K. trained agent/engineers abroad. The immediate response was encouraging, and individual enrolments have now reached a steady annual two-thousand or so. The courses themselves are designed so that the student can commence at the beginning and work his way through in monthly instalments until he has acquired a fair state of knowledge. Question and answer papers at intervals enable him to check his progress, and a special department at the Spirax headquarters in Cheltenham will help him with any particular problem. The more advanced student can by-pass the early folios if he so wishes, or can use them as a refresher before taking up at the appropriate point. Some of the strongest patrons of these courses have been lecturers in technical colleges who, having worked through the courses themselves, have arranged to have a whole class enrolled and have then been able to work profitably through a carefully graded syllabus which does not otherwise exist. The company has established a reputation for pioneering correct steam-using techniques in the less industrialised or underdeveloped countries. It is not surprising, therefore, that many of the keenest and most appreciative students are in those parts which are much worse off than Britain for technical instruction at the right level. India, Australia, New Zealand, South-East Asia and South Africa are the more obvious cases in point. When the first enrolments were made, it seemed desirable in the purely administrative sense to keep careful records of who was proposing to take what. It also seemed desirable to keep a note of how students progressed in their careers, but there was a fear that they might resent being documented, however good the reason, by a commercial firm. This fear has proved to be totally unfounded, and many students take great pride in writing to Spirax from time to

*Mr. L. G. Northcroft, O.B.E., Chairman of the Spirax-Sarco Engineering Group of Companies, making a presentation to the 50,000th Student in the Spirax Postal Instruction Course.*

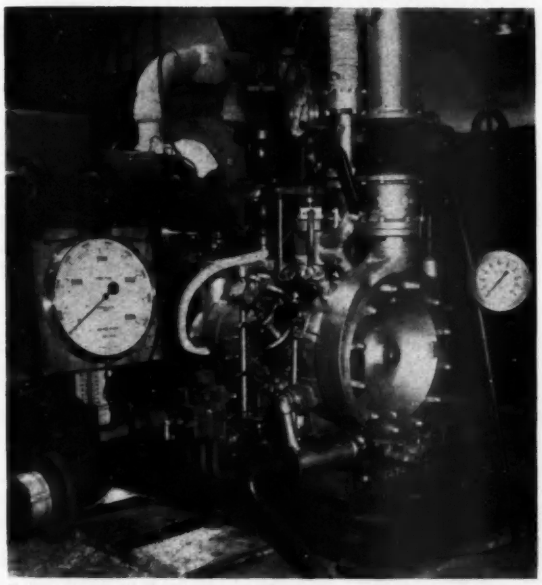
time to say how they are getting on, and frequently to ask for their colleagues to be enrolled or (with the passage of time) their own subordinate staff.

It is of interest to note that enrolments for the Spirax Postal Instruction Courses reached the 50,000 mark at the end of 1960. This milestone was recognised on January 9th this year, at the company's head office in Cheltenham when the 50,000th student received the appropriate welcome. He is William Greenwood, an 18-year-old apprentice with the Brightside Heating & Engineering Co. Ltd., the well-known heating contractors, at their Newcastle-upon-Tyne Works. Welcoming him before a gathering of directors and departmental managers, Mr. L. G. Northcroft, O.B.E., chairman of the Spirax-Sarco engineering group of companies, briefly reviewed the origin and history of these courses. Students from as many as 64 countries had benefited from them, and the company was proud to feel that it had done something towards exporting technical knowledge to some of the less developed countries in the world. Mr. Northcroft explained to apprentice Greenwood that something like one in five of all students resided overseas, that the six enrolments immediately before him were from distant parts of the globe, and that perhaps it was just as well, all things considered, that the 50,000th student had to be brought no further than from Newcastle upon Tyne. For that matter, it was perhaps a fortunate convenience that the lucky number had not, so to speak, been drawn by one of the small but very keen band of students who were seizing the opportunity of improving their knowledge while serving prison sentences.

The visit of apprentice Greenwood to Cheltenham would be long enough to enable him to tour the various Spirax-Sarco offices and factories there, but Mr. Northcroft was happy to offer him more tangible reminders of his most welcome visit. These were an engraved slide-rule, a commemorative scroll, and a copy of Mr. Northcroft's own very informative book " Steam Trapping and Air Venting." Mr. Northcroft expressed the company's pleasure at being able to do honour to apprentice Greenwood in his own right and, through him, to congratulate his 49,999 predecessors who had had the same keenness and willingness to study outside their curriculum.

# The Pulsometer " Pacific " Steam Turbo Pump

We were recently invited to visit the works of The Pulsometer Engineering Co. Ltd., at Reading, for the purpose of touring the factory and inspecting the new Pulsometer " Pacific " steam-turbo pump for boiler-feed duties, and which the company had on test. The company, which produces a wide range of pumps covering a variety of applications, claims that it has now provided the solution to the problems of weight, space and high rotative speeds, where boiler feed pumps are concerned by introducing the " Pacific " steam-turbo pump. This pump combines a steam-turbine drive and a centrifugal-pump to form a self-contained compact pumping unit capable



*Pulsometer " Pacific " steam turbo-pump on test in the works at Reading, of the Pulsometer Engineering Co. Ltd.*

of continuous operation at rotative speeds from 5,000 up to 10,000 r.p.m. It is being built under licence from Pacific Pumps Inc., California, U.S.A. As the designs are standardised, there is complete interchangeability of parts. It provides an attractive alternative to the solid-casing type of boiler feed-pump, being compact and comparatively light in weight. Compared with multi-stage units of equal capacity, it occupies anything from 50 to 70 per cent. less floor space and is from 25 to 40 per cent. lighter. As a result, considerable economies may be effected where the initial capital outlay is concerned. The pump is of the single-stage impulse-type, equipped with a centrifugal-type speed-governor, automatic overspeed trip, hand trip and hand-reset. It is of the single-stage diffuser type with single-inlet impeller, the turbine bucket-wheel and the pump impeller being mounted on a common shaft which is supported in two pressure-lubricated sleeve-type bearings. The pump is claimed to be flexible and readily adaptable to a wide range of capacities and pressures. It is capable of delivering to a boiler, up to 750 gal./min. of feed-water against feed pressures up to 1,100 lb./sq. in. g., with steam pressures up to 900 lb./sq. in. g., and total temperatures up to 900 deg. F. and exhaust at pressures up to 150 lb./sq. in. g. The sizes and ratings of Pulsometer " Pacific " turbo pumps have been developed to permit the selection of a turbine-pump combination that will ensure the maximum economy from any installation. The steam-turbine driving unit is made in two sizes, both of which can be furnished with either a single or double-row bucket-wheel. Both are suitable for operation with steam pressures up to 900 lb./sq. in. g. and temperatures up to 950 deg. F.; exhaust pressures up to 150 lb./sq. in. g. are standard, with 300 lb./sq. in. g. as the maximum with an ejector, for pressures above 150 lb./sq. in. g. One size turbine can be furnished with either a 1½ in. or a 2 in. steam flange, the other with a 3 in. steam flange only, and both sizes with exhaust flanges from 4 in. minimum to 12 in. maximum, depending upon requisite conditions. Among the features of the pump which are of special interest is the fact that the rigid shaft, low overhang, and single-stage construction means that the pump wearing-rings run with a definite clearance, do not act as internal bearings, and are thus unaffected by a continuous flow of liquid. Turbo-pumps for single-operation have nearly a dead flat head-capacity characteristic. Therefore, with the flat governor characteristic, results are practically identical with constant-discharge pressure-governing. For parallel operation, characteristics rising continuously from rating to shut-off are furnished, involving some loss in efficiency and the need for pressure governing.

An arrangement has been signed between **Engelhard Hanovia Lamps,** a branch of Engelhard Development Company of Canada Ltd., and the **" Alfloc " Water Treatment Services of Imperial Chemical Industries Limited,** whereby the latter will, in future, undertake sales and technical service in Great Britain and Northern Ireland of Hanovia ultra-violet radiation equipment for the sterilisation of water. This arrangement is intended to enable the specialised knowledge of Engelhard Hanovia Lamps regarding the use of ultra-violet radiation in industrial processes to be made more readily available to users of water, with whom " Alfloc " water treatment service is constantly in touch. The special technical advantages of ultra-violet radiation in water treatment will henceforth be considered in relation to other forms of sterilisation so that the best solution for any specific problem or set of conditions may be recommended.

# RECENT Equipment AND Accessories

### Raymond flash drying systems

Raymond flash drying systems (Fig. 1) now introduced to this country for the first time by International Combustion Products Limited, are used to remove definite amounts of moisture from damp, granular or fibrous material. The material is circulated in a hot, turbulent gas-stream, causing the rapid transfer of heat and evaporation of moisture. When simultaneous drying and grinding is required, a disintegrator or pulveriser is included in the system. The finished product is separated, cooled and conveyed in a dust-free plant operating under suction, and its dryness and particle size may be accurately controlled, Raymond flash drying systems are widely used for

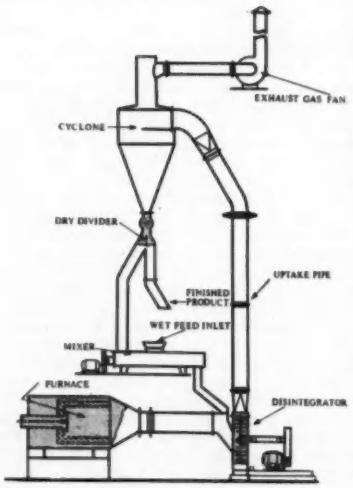



*Fig. 1. Raymond flash drying systems. (International Combustion Products Limited.)*

drying such materials as wet coal-cake and sewage-sludge, and also for the preparation of chemicals, foods and fertilisers. Flash drying systems are designed to accomplish drying under three distinct conditions:—drying without disintegration, drying with disintegration, and drying and pulverising. The standard elements of the system are given below; some systems require all the elements, whilst others may omit one or more of them. Hot gas is supplied either by direct-firing, indirect-heating or the use of waste gas. International Combustion furnaces, operating on gas, oil, or coal, and heat-exchangers are provided to meet these conditions. Several wet feeder arrangements are available, allowing the rate of feed to be changed as required. The mixer is used to condition the incoming wet feed by blending it with previously-dried material. A product is thus obtained which can be easily picked up by the hot gas-stream. A cage or impact mill is incorporated in the system when simultaneous drying and grinding is required. Wet material is fed into the hot gas-stream, and the mixture then enters the mill axially. The product leaves the mill almost completely dried, but mixed with the gas. After passing through the uptake pipe, this mixture enters the cyclone collector, where separation occurs, and the moisture-laden gas is discharged to atmosphere through the vent fan. A bag filter, cyclone, or wet scrubber is sometimes included in the system after the exhaust fan. The dry divider proportions the finished product when dry return is needed for conditioning the incoming wet feed. This proportioning device may be either manually or automatically controlled. (*International Combustion Products Limited, Nineteen Woburn Place, London, W.C.1.*)

### New "Resistron" liquid level controller

Following upon the success of their "Leveltron" and "Levolog" capacitance-operated level-controllers and indicators, Thomas Industrial Automation Limited have now produced a compact conductivity-operated liquid-level controller known as the "Resistron." This instrument, say the makers, has been designed to fulfil the need for a low-priced industrial liquid-level controller of exceptional reliability. The equipment does not involve any moving parts in or on the container, and a full range of electrodes is available in two forms, either as a fixed-sensitivity instrument for high or low level, or fitted with a continuously-variable sensitivity-control and high/low change-over switch. The "Resistron" is intended for use with any conducting liquid providing the specific resistance does not exceed 50,000 ohms per cu. cm. It is ideal for the control of various types of acid, and for controlling the level of water in feed-tanks, etc. In conjunction with a high-temperature electrode it can be used for boiler level control, and will give audible and visual alarm as well as taking corrective action when the water in an unattended boiler has fallen to a dangerous level. Stability is ensured by the use of high grade mains-transformer and components as well as a dust-sealed relay and special purpose valve. The controller is available in a sheet-steel or cast-iron case fitted with two signal lights. The "Fail-to-Safe" facility is standard on all types. (*Thomas Industrial Automation Limited, Station Buildings, Altrincham, Cheshire.*)

### New MilTherMatic steam trap

Midland Industries Limited have recently introduced a new steam trap to add to their already extensive range. Whilst the principle of operation of the MilTherMatic steam trap (Fig. 2) is simple, it is claimed to be somewhat revolutionary in design, having only one moving part—the valve. It has been specifically designed to meet the needs of modern plant, with special emphasis on its ability to discharge condensate at steam temperature, consistently from no load to maximum. The makers claim that minimum maintenance with a consequent reduction in labour costs is assured due to there being only one moving part, and all internals

*Fig. 2. New MilTherMatic steam trap. (Midland Industries Limited.)*

can be replaced *in situ*. In operation, the valve is held on its seat by the conversion of the kinetic energy of flashing condensate into pressure energy. When this pressure is removed by recondensation, the valve will open to discharge the condensate from the equipment being drained. The trap is claimed to be suitable for use on a wide variety of applica-

tions and at pressures from 5 to 250 lb./sq. in., with manganese-bronze body, or from 5 to 400 lb./sq. in. with stainless-steel body. It is available with either ½ in. or ¾ in. screwed B.S.P.T. or A.N.P.T. connections. An ample straining capacity and sludge collection reservoir are claimed for the trap which uses no gaskets in its assembly, all mating surfaces being of metal to metal contact. (*Midland Industries Limited, Heath Town Works, Wolverhampton.*)

**Light-sensitive oil burner control**

The latest Danfoss innovation in the field of automatic oil-burner controls, is a light-sensitive control box, Type 57F (Fig. 3) incorporating the most recent developments in connection with semi-conductors. The relatively expensive electronic amplifier, which has so far been necessary to produce sufficiently strong relay current, has been rendered superfluous through the application of a photo resistor as the "light-sensitive" element. The result is claimed to be a simplified yet reliable product, of small dimensions and pleasing appearance with considerably prolonged life as a consequence of the omission of the sensitive amplifier tube. The type 57F unit needs no "warm-up" time before starting and will, moreover, guard against short-circuiting or earthing of the photo unit leads. Being of the plug-in design, it is easy to install and simplifies service. All terminals are readily accessible, and the control box can be fitted in any position. (*Danfoss London Limited, 13, Queensway, London, W.2.*)

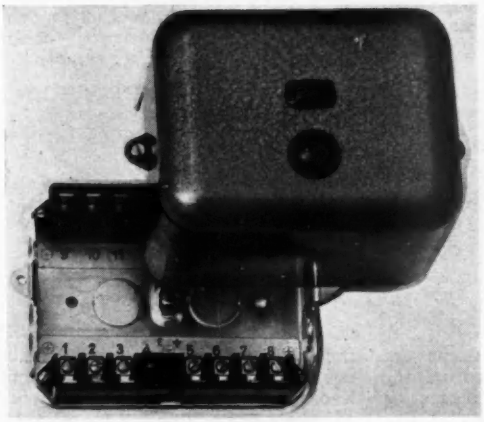


*Fig. 3 (left). Light-sensitive oil burner control. (Danfoss London Limited).*

**The Tinsley Polarograph "Mk 200"**

The Tinsley Polarograph "Mark 200," manufactured by Evershed and Vignoles Limited, is an instrument designed for both research and industrial requirements. Its field of application covers investigations into electro-chemistry, stability constants of reducible compounds and characterisation of certain complex organic materials. It is claimed to be an accurate and sensitive analytical tool capable of trace-determination of materials in solution to better than 0.02 p.p.m. The classical d.c. circuit employed, permits its operation from any type of electrode system, i.e., D.M.E., vibrating and rotating solid electrodes, etc. The electrode may be positive or negative with respect to the reference electrode. The Polarograph Mark 200 embodies a newly-designed galvanometer transistor d.c. amplifier which uses two parallel feed-back circuits to adjust sensitivity in one feed-back loop, and speed of response in the other. The recorder, on which the final polarograms appear, presents the trace on a horizontal table on which the operator may write the relevant experimental data most conveniently. The indicators for voltage and sensitivity are arranged at eye-level, and can be scanned at a glance, whilst the controls, which are kept at the same setting throughout a series of experiments, are arranged below the recorder table. The Potentiometric recorder itself has an effective chart width of 200 mm. allied to a response time of 1 sec. and embodies its own integral amplifier. Two chart speeds are provided. The overall sensitivity of the Polarograph covers from 0.02-100 microamps for full-scale deflection. An interesting new feature is the provision of a peak reading unit (patent applied for) which eliminates capacity current noise from the normal D.M.E. and thus permits the chemist to obtain virtually undamped polarograms at all sensitivities, without loss of resolution on both direct and derivative polarograms. Conventional damped polarograms may also be recorded (derivative type damping is used) and little or no zero shift will occur either with direct or derivative polarography. The potentiometer covers a voltage span from + 0.5-3 and reverse with five scanning speeds for increased resolution. The new polarograph is housed in a metal case, and makes use throughout of transistorised circuitry and printed circuits, arranged in plug-in units, to facilitate servicing and maintenance. The potentiometric recorder may also be used as a recording microammeter over its working range, without modification as suitable switching is provided. (*Evershed and Vignoles Limited, Acton Lane, London, W.4.*)

*Fig. 4 (right). Single section instrument and automatic-control panel. (George Kent Limited).*

**Kent export achievement**

George Kent Limited recently despatched from their Biscot Road, Luton, works, the largest single-section instrument and automatic-control panel ever manufactured by the company. This cabin-type panel, measuring approximately 16 ft. long, 8 ft. high and 7 ft. deep, was supplied to the order of Babcock and Wilcox Limited for the South African Electricity Supply Commission's Hex River Power Station, for which a considerable amount of other Kent equipment is being supplied. Wholly assembled complete with control desk and canopy, the unit (Fig. 4) was enclosed for transportation in a single large packing-case which alone weighed almost 4½ tons. A point of no less interest was the equipment's scheduled arrival at Capetown in the s.s. *Windsor Castle* on Thursday, December 22nd, representing a period of only three weeks between completion and delivery in South Africa. The Hex River station is operated by the Cape Western Undertaking. During the year ended April 30th, 1960, extensions under construction comprised one 30-MW turbo-alternator set and a 275,000 lb./hr. boiler. This plant is expected to be commissioned early this year, while another and similar generating set and associated boiler unit have been ordered for commissioning in 1963.

During the year referred to, Hex River sent out 183·385 million units, the station peak load being 61.6-MW, the load factor 35 per cent., and the thermal efficiency 22.8 per cent. The amount of coal consumed was 118,369 tons, the fuel consumed per unit sent out being 1,291 lb. (*George Kent Limited, Luton, Bedfordshire.*)

**Welding inspection at Hunterston**

Rated at 400 KVp, the five Pantak X-ray units used to check the welds of the reactor pressure-vessels at Hunterston are claimed to be the largest constant-potential units currently produced in the U.K. At this nuclear power station, where work is now well advanced by the G.E.C.-Simon-Carves Atomic Energy Group, The Motherwell Bridge & Engineering Co. Ltd. have responsibility for the fabrication of reactor pressure-vessels and steam-raising units, and are employing five Pantak X-ray units of 400-KVp (Fig. 5) capacity and three of 220-kV capacity. The 400-KVp machines use a constant-potential or double Greinacker circuit which has a small rectified "ripple" characteristic. This characteristic, together with the use of metal rectifiers which provide stable operating conditions, enables the maximum penetration power to be obtained for the current used. Exposure time at Hunterston for a 3-in. thick weld is 7 min., using a 400 KVp set in conjunction with Kodak "D" film and lead screens. This relatively short exposure time enables a high degree of sensitivity to be achieved. Of particular note in the operation of these machines is the high degree of operator safety which is afforded by extensive lead shielding within the tube, a feature which enables other routine work to be carried on in reasonable proximity to the area where radiography is being carried out. Although 250-kV machines could be used for this duty, the comparable exposure time would be 20 min. and would be accompanied by a corresponding lack of definition due to scatter radiation. This problem becomes accentuated as plate thickness increases and as pressure vessel fabrication moves steadily into the region of 4-in. thick material and above, increasing interest is being shown in such particle accelerators as the betatron to provide a high energy source of X-rays which will allow high speed, hot state radiography to be undertaken with the minimum of scatter. (*Pantak Limited, Vale Road, Windsor, Berks.*)

*Fig. 5 (left). Pantak 400-KVp mobile X-ray unit. (Pantak Limited.)*

**"Saturn" gas turbine**

Perkins Gas Turbines Limited, a subsidiary of F. Perkins Limited, is now marketing the latest American-built Solar gas turbine—the 1,250 h.p. "Saturn," suitable for many military and industrial applications. It can be used, for example, as a propulsion unit for fast boats, as a power source for electric generators, as a ground support unit for advanced jet aircraft, and for many types of pumps for flood water control, product pipeline pumping, or mobile equipment. Available in both constant and variable-speed versions, the "Saturn" solar gas turbine is claimed to be one of the most efficient engines of its type ever developed. A direct drive of 20,000 r.p.m. is available for use with the latest designs of high speed air and gas compressors. Reduction gearing can be eliminated to reduce initial cost and maintenance. Equipped with push-button starting, the "Saturn" gas turbine requires no warm-up and reaches full power in a maximum of 40 sec. even after long standby periods and in extreme climatic conditions, varying from below zero to 130 deg. F. It can be operated efficiently on most types of fuel, including petrol, paraffin, diesel, jet fuels, and natural or manufactured gas. The "Saturn" is rated at 1,250 h.p. for intermittent use and 1,100 h.p. for continuous use. The engine has a thermal efficiency of 23 per cent. and a fuel consumption of 0.60-0.63 lb./hr. The basic "Saturn" engine weighs about 950 lb., or less than one-tenth the weight of conventional engines of similar horse-power and service life. It occupies 50 cu. ft., is 69 in. long, 45 in. wide, and 44 in. high. A dry-sump lubrication system is used and low heat rejection permits use of a small oil-to-air or oil-to-water heat-exchanger for cooling. (*F. Perkins Limited, Peterborough.*)

**Narda ultrasonic "Sonblaster"**

The use of the principle of ultrasonics in industry is steadily increasing and its applications in general engineering are now numerous, chiefly in cleaning and degreasing processes. It is being applied in this field in the cleaning of bellows, bearings, air-conditioners, valves and fittings, oil-burners, etc. The principle of operation of ultrasonic cleaning consists of turning high-frequency sound waves into mechanical energy. The sound waves which are generated electrically at a wave length inaudible to the human ear, compress and decompress the solution in the ultrasonic tank, and the molecular agitation thus set up removes all foreign matter from the material being treated, leaving its surface completely unharmed. A full range of ultrasonic equipment produced by one of the leading manufacturers of this type of material in the U.S.A. is now available in this country. This is the Narda Ultrasonic Corporation's "Sonblaster" range (Fig. 6) which consists of generators, submersible transducers and transducerised tanks. The generators, which can be either electronic or motor-driven, vary in size from a model which energises one transducer, to the largest which is capable of energising 30 to 40 transducers simultaneously. The range of tanks available, consists of models containing approximately one quart of liquid for laboratory use or for cleaning small precision parts, to units which contain 75 gal. for heavy industrial use. Altogether, more than 100 combinations of generators, transducers and tanks are

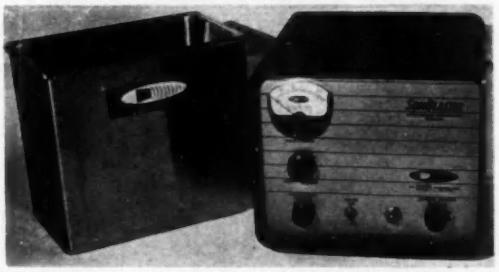


*Fig. 6 (below). Narda ultrasonic "Sonblaster." (Narda Ultrasonic Corporation.)*

possible to cater for practically any cycle of cleaning processes. The economies claimed to be effected by the use of ultrasonic cleaning equipment are:—low initial cost of the equipment and low installation charges, lower consumption of detergents and solvents (in some cases these can be dispensed with completely), and low operating costs. The direct advantages claimed are:—considerably increased speed of operation (in addition to the fact that the process is much faster than any other method, batch process parts can frequently be treated together) more thorough cleaning, and the elimination of the possibility of damage to delicate parts. Cleaning of complete assemblies is very often possible. The equipment is guaranteed for two years except for the valves for which a three months' guarantee applies. (*Narda Ultrasonic Corporation, 44, Tower Hill, London, E.C.3.*)

**New industrial control relay**

A new industrial control relay was recently introduced by Square D Limited. This control relay (Fig. 7) designated class 7001 Type D, is a compact, 10 amp. maximum 250 V, d.c. operated relay, the contacts of which can be used to switch a.c. or d.c. supplies. With the exception of the magnet system, this relay is an exact replica of the a.c. operated relay already produced by this company. The relay is manufactured in three basic types. The first provides up to four contacts, the second up to six contacts, and the third up to 10 contacts; all relays have identical mounting dimensions, and this facilitates substitution of one relay for another. Although small in physical size, overall construction is claimed to be exceptionally robust making for long, trouble-free mechanical and electrical life. Operating coils are available for voltages up to 250 V d.c., and are encapsulated in an epoxy-resin moulding which gives protection against mechanical damage and moisture absorption. All contacts are of the double-break type and are silver to silver, while terminals are provided with pressure-wire connectors and tilted for ease of installation. Also newly available for use with these relays is a mechanical latching attachment, designated Class 7008, Type M1, to convert relays from electrical hold to mechanical hold. This attachment has identical mounting holes to the relay, thus permitting easy conversion from one type to another after installation, without increase in mounting area. (*Square D Limited, Cheney Manor, Swindon, Wilts.*)

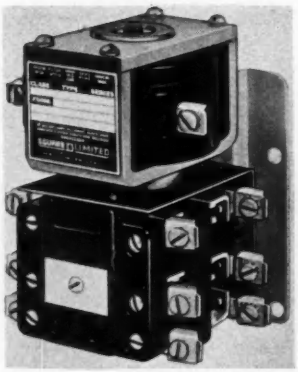


*Fig. 7. New industrial control relay. (Square D Limited)*

**Automatic liquid sampler**

The use of the Elcontrol automatic sampler, a self-contained battery-operated portable unit which has been recently introduced, is claimed by the manufacturers to save many hours of technicians' time, and as it can be "set" and left on site, samples can be taken at any time, day or night (and in awkward sites). Being automatic, samples are taken at regular predetermined intervals, thus increasing accuracy of sampling. The automatic sampler is claimed to be most useful in regular sampling at many stages in water-purification and sewage-purification processes. Not only water and sewage authorities and river boards, but also chemical plants, oil-refineries and power stations will find it of use for conducting a comprehensive survey on various stages of their processes, and particularly where it is suspected that cooling-water or condensate is being contaminated. The sampler consists in essence of a complete self-contained unit fitted with twelve 20-oz. sample bottles. Each bottle is sealed by an airtight plug through which passes a rubber tube connected to an outlet. All the outlets are accessible on a panel at the end of the unit and both bottles and outlets are numbered for easy identification. The rubber tube from each sample bottle is controlled by a magnetic pinch valve. Each pinch valve can be manually closed and subsequently re-opened electromagnetically. The magnetic pinch valve is closed manually and retained by a permanent magnet. It is re-opened by a pulse from the power supply via the stepping relay which opposes and overcomes the pull of the permanent magnet. The unit contains in addition to the sample bottles, etc., a 15-day clockwork motor and a transistorised power pack, driven by a 6 V lantern battery (giving several weeks' life). The complete unit measures 24 in. long × 15 in. high × 10 in. wide and is provided with a carrying handle at each end. Each of the long sides forms a door which is hinged along the lower edge, thus exposing six sample bottles and the appropriate switches on each side. The sampler case is constructed of mild-steel with an aluminium outer-shell, thus keeping weight down to a minimum whilst retaining maximum rigidity and strength to withstand rough handling under arduous outdoor conditions. The case is rendered water-tight by the use of neoprene-rubber sealing-gaskets on the doors, and is provided with adequate rubber feet. (*Elcontrol Limited, Wilbury Way, Hitchin, Herts.*)

**"Spot-Tight" pivoted-disc valve**

The patented "Flexiseat" pivoted-disc valve is shortly to be produced under licence by Charles Winn & Co. Ltd., and marketed as the "Winn-Flexiseat" by their wholly-owned subsidiary, B.W. Valve Co. Ltd. The features that the manufacturers claim give the "Flexiseat" valve (Fig. 8) its performance, are the adjustable "rigid-flexible" seating and the combination of both angular and axial-movement of the disc in its closing action, thus giving positive, compressive seating over the entire periphery, with the resulting "spot tight" closure which is the outstanding feature of the "Flexiseat" valve. It also embodies the accepted advantages of the "butterfly" type valve, which are, that size and weight are considerably reduced, distortion is almost eradicated, and ease and smoothness of operation are ensured by equilibrium of the opposing pressures on the two opposite halves of the disc. "Spot-tight" closure is only possible where there is absolute control of the seating-ring, and this is achieved in the "Flexiseat" valve by the use of a separate ring of flexible material which is moulded

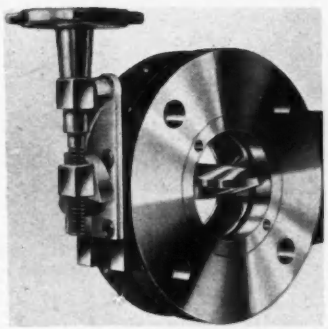


*Fig. 8. "Spot-Tight" pivoted-disc valve. (Charles Winn & Co. Ltd.)*

round a strong metallic-core, and is securely located in a deep annular groove in the body, where it is held by a screwed, adjustable retaining-ring which exerts the necessary compression to position the seating surface accurately and controllably in relation to the disc. The "Flexi-seat" valve is claimed to be particularly adaptable to automatic operation, and close attention will be given to methods of actuation by pneumatic, hydraulic and electric control, including automatic "positioning" where required. Manufacture has already commenced, and it is expected that the initial range, in the 150 lb./sq. in. class for water, gas, air and oil will very shortly be available in sizes from 3 in. to 6 in. followed later by sizes up to 12 in. and eventually up to 24 in. This will be followed by regular extensions of the pressure/temperature range for which the valves will be offered, and also in the range of materials in which the valves will be manufactured. [*Charles Winn & Co. Ltd., Birmingham (marketed by BW Valve Co. Ltd., 140, Granville Street, Birmingham).*]

**Four-way positioning air valve**

Ad. Auriema Inc., New York, U.S.A., have sent us details of a new three-position four-way air-valve which has recently been announced by Mechanical Air Controls Inc. Most air-valves used today are simple, on-off, two-position valves that actuate an air-operated device with no intermediate position. The new three-position valve, claim the manufacturers, fulfils the need for a positioning valve that can "inch" an air-actuated device to any desired position and hold it there. Solenoid-operated, it is available in either closed-centre or open-centre design. With M.A.C. "Flo-Seal" design and solenoids, the new three-position four-way valve (Fig. 9) contains only three working parts, spool and positive centring spring-loaded sleeves. Both Model 1063 (closed centre), and Model 1073 (open centre), are equipped with built-in manual operators to facilitate machine set-up, etc. The $\frac{3}{8}$ in. port size valve utilises a pre-wired body and base with a plug-in feature that allows the valve-body to be removed without disturbing any electrical wiring. When the body is re-assembled, connection is automatically made. These valves operate at working pressures from vacuum up to 150 lb./sq. in. (*Ad. Auriema Inc., 85, Broad Street, New York, 4, N.Y., U.S.A.*)

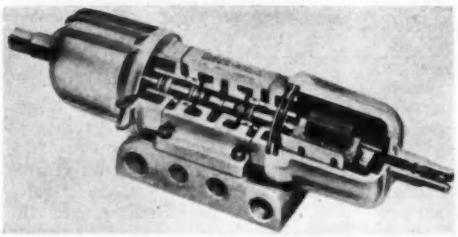


*Fig. 9 (left). Four-way positioning air valve. (Ad. Auriema Inc., U.S.A.)*

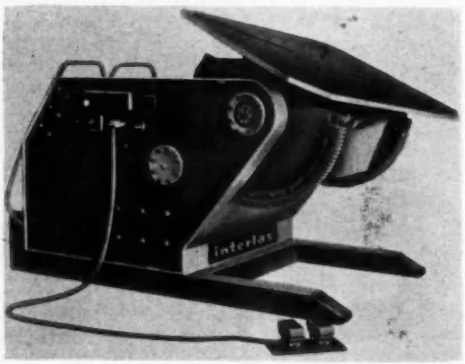



*Fig. 10 (right). "DB 1000" welding positioner (Interlas Limited).*

**New Airetool balancer**

A new range of pneumatic tool balancers and air-hose couplers, for pneumatically-operated tools, is now available from The Airetool Manufacturing Company. The new Airetool balancer is claimed to eliminate accidental tool droppage, and as a result, cut tool replacement costs. With the use of an Airetool balancer, tools are "out of the way," but within easy reach. Airetool balancers are engineered to reduce operator fatigue and boost production. The balancer is completely portable for use anywhere in the workshop, and "hooks" easily to an overhead beam. It features heavy-duty construction, fast reel return, easy tension adjustment, safety declutching, straight-line action, adjustable cable stops, smooth operation, and swift, easy cable replacement. Airetool air-hose couplers are designed for positive, heavy-duty, low-maintenance service, and help to produce maximum air-flow with minimum pressure-drop under exacting conditions. Airetool hose-couplers are available for hose sizes of $\frac{1}{4}$ in., $\frac{3}{8}$ in. and $\frac{1}{2}$ in. (*The Airetool Manufacturing Company, Springfield, Ohio, U.S.A.*)

**Ferranti transformers for Australia**

Against strong competition from Continental and Asian countries, Ferranti Limited have obtained a contract worth over £400,000 from the Electricity Commission of New South Wales, for the supply and installation of three 240-MVA, 16.5/348-kV, three-phase generator transformers. The units, which will be the largest with aluminium tanks ever built in the United Kingdom, are to be installed at Vales Point Power Station which is located 70 miles north of Sydney. Aluminium tanks will keep the weight of each unit down to 147 tons for transport purposes. Integral high-speed, on-load, tap-changing gear will also be provided for each unit, the first of which is scheduled for delivery about the end of 1961. The contract was negotiated through Wilson Electric Transformer Co. Pty. Ltd., Melbourne, who will undertake installation of the transformers. The transformers which will be off-loaded at Sydney, will be the largest ever to be imported by Australia, and because of their size will present a number of delivery problems. A complete unit with cooling equipment will weigh 265 tons, of which the largest single section will be the core, windings, on-load gear and tank assembly, dimensions of which are 29 ft. long × 12 ft. wide × 14 ft. high. Weight is 147 tons. (*Ferranti Limited, Hollinwood, Lancs.*)

**New range of welding positioners**

A range of variable-speed welding positioners new to Great Britain was recently announced by Interlas Ltd. These machines are made for Interlas by Tehag of Germany, and 10 models cater for maximum loads of from 33 lb. to 10 tons. The bench model "DB 15" is the smallest of the range, having a capacity of 33 lb. It has an infinitely variable speed range of 0.3 to 3 r.p.m. with a foot-operated remote control for "stop" and "start," thus allowing the operator to have both hands free for welding. A 12-in. dia. slotted top-plate has a built-in earthing attachment, and can be tilted and locked in any position throughout 360 deg. of movement. A switch for "forward" and "reverse" motions is provided on the front of the machine, along with screw-out fuses. At the other end of the range, the 10-ton model "DB 10000" (Fig. 10) has a speed range of 0.06 r.p.m. to 1.2 r.p.m., a 5 ft. sq. top-plate, tilting at 0.5

r.p.m. through heavy-duty twin-tilting segment gears, and a 750 amp. earthing attachment. Remote controls with foot operation can be provided for "stop" and "start" motions of rotation and tilting, or, alternatively push-button remote controls for "forward," "stop," "reverse," "fast-slow" for rotation, and "up" and "down" for tilting. Between these models are positioners for maximum loads of 2 cwt., 5 cwt., 1 ton, 1½ tons, 2½ tons, 3½ tons, and 6 tons. Complete jigs for the automatic welding of small cylinders are also obtainable, consisting of rotating equipment and supports for the welding head, with all necessary electronic controls. (*Interlas Limited, Ampthill, Bedford.*)

**New photo-electric warning system**

A photo-electric cell unit that will operate only when the light beam is interrupted in one direction is now being produced by Hird-Brown Limited. Should an object pass through the beam in the reverse direction nothing will happen. Only one photocell housing is used to achieve this result, and no relays are involved. This new technique can be incorporated into a photo-electric warning system that has also been recently introduced by Hird-Brown Limited, for giving an audible or visible alarm when a change occurs The warning system can be used to monitor moving webs of any material, including paper, polythene, rubber or steel, and immediately indicates when a break or tear occurs. In other uses it will show when persons or objects pass a fixed point, and will also act as a height or level-gauge. The warning can be "set" on site to sound continuously, or to stop ringing after 5 to 15 sec. The equipment is suitable for operation indoors or outside under wide temperature variations, and is suitable for beam lengths of up to 75 ft. As well as giving a warning signal, a range of recorders is available to record the times of breakage, etc., and further contacts are provided for the operation of emergency stops. Several beams can be connected to a single control unit. (*Hird-Brown Limited, 244, Marsland Road, Sale, Cheshire.*)

**Watts automatic stoker**

Watts Automatic Boilers have recently introduced an automatic stoker unit which can be applied to any ordinary type of boiler such as in general use for hot water and central heating systems in industry and in large private residences, hotels, etc. The Watts automatic stoker is available in a range of standard sizes for cast-iron sectional boilers, with capacities from 150,000 B.Th.U./hr. to 1,000,000 B.Th.U./hr. The stokers operate on a gravity-hopper and feed-tube system and incorporate only one moving part, a small electric fan with an almost negligible electric power consumption. With the use of the stoker, the manufacturers claim that the labour of hand-firing methods is abolished, as only some 10 min. attention is required every 24 hours, except with the very largest boilers. Fuel economy results from the fact that fuel is only used according to the demands made by the heating system, and from the fact that high-heating quality anthracite can be used, and this is generally of a lower price than similar fuels used for hand-firing. All Watts units are supplied with a thermostat for the control of hot water temperature, and this temperature, it is claimed, can be simply set, quickly obtained and maintained for as long as desired. Additional controls are available as extras, including a kindling switch, which automatically cuts in the fire when the boiler has been out for a period where there have been no hot water demands; a room thermostat, enabling temperatures to be controlled by the temperature of the room instead of the heat of the water; and a time-switch, which is used in conjunction with the kindling switch to cut the thermostat in and out automatically at times when no heat is required. (*Watts Automatic Boilers, High Street, Lydney, Glos.*)

---

Peterborough City Council have awarded the contract for pumping plant for the conversion of their Etton Pumping Station to **W. H. Allen Sons & Co. Ltd.**, Bedford. The contract, which is valued at more than £44,000, is for two 14/12 in., and two 12/10 in. horizontal-spindle double-suction pumps driven by variable-speed electric motors. The contract also includes the supply of switchgear, valves, pipework, steelwork and auxiliary equipment.

* * *

A few weeks ago, the turbine factory at the Rugby works of **Associated Electrical Industries Limited,** was incorporated in the A.E.I. Heavy Plant Division. This factory, and the adjacent buildings used for the manufacture and testing of large electrical machines, have been re-named "Large Machine and Compressor Department." **Mr. J. D. Riddle,** formerly manager of turbine factory, has been appointed manager of the new department, and **Mr. R. Evans,** formerly superintendent of large machine production in Heavy Plant Factory, has been appointed assistant manager.

* * *

The Minister of Power has appointed **Mr. F. Linley,** M.I.E.E., A.M.C.T., as deputy chairman of the North Western Electricity Board in succession to **Mr. T. Coates,** M.Eng., M.I.E.E., M.I.Mech.E. Mr. Linley was manager of the No. 1 (Manchester) Sub-Area and has also been a member of the Board since 1959.

For the first time in the company's history, annual steel output of **The United Steel Companies Limited** has exceeded three million ingot tons, while pig iron production was over two million tons, also for the first time. The 1960 production figures, reproduced below, reveal record outputs of coke, ironstone, pig iron and steel. At the Samuel Fox branch, ingot steel output has topped the 400,000 ton mark for the first time, while Workington's steel output also set a new high level at over 300,000 tons. Pig iron production at Workington exceeded 500,000 tons for the first time, and coke production at Appleby-Frodingham was increased by over 125,000 tons during the calendar year. The company's ore mining branch produced a new record tonnage of ironstone, beating the 1959 figure by 470,000 tons.

* * *

The National Coal Board announce the appointment of **Mr. W. M. Crooks** as deputy-chairman of their Durham Division. Mr. Crooks, who is finance director of the West Midlands Division of the Board, succeeds **Mr. A. H. Kellett,** who has been appointed chairman of the South Western Division.

* * *

**Mr. A. J. R. Walter** has resigned from the board of The Permutit Co. Ltd., upon reaching retiring age. He will, however, continue to be available in a consultative capacity.

**Commander P. W. Kent,** R.N., chairman of George Kent Limited, presided at the company's 1960 annual long-service presentations held recently at Biscot Road Works, Luton. The 1960 ceremony not only marked the 25th anniversary of the inauguration of the scheme by the late Sir Walter Kent, but was made doubly significant by the fact that the recipients' total service amounted to 1,095 years—a record figure. Included in the 41 certificates altogether awarded for that year were one for 45 years' and two for 50 years' service. One of the several board members in attendance, Mr. R. S. Medlock, research and engineering director, himself received a 25-year certificate.

* * *

**Mr. N. R. Dent,** A.M.I.Mech.E., has been appointed manager of the Fisher Governor Co. Ltd., a member of the Elliott-Automation Group. He joined Elliott Brothers (London) Ltd. in 1957 as establishment manager at the company's Rochester factory. Before joining Elliotts, he was works director at Engineering Productions (Clevedon) Limited, and a director of the holding company, Western Engineering & Motor Services Limited.

* * *

**Mr. A. N. Irens,** M.I.E.E., has been re-appointed chairman of the South Western Electricity Board for a further period of five years from March 1st, 1961.

# OVERSEAS Steam Engineering Practice

*Abridgments of recent articles in the colonial and foreign technical press, concerning design and progress in the technique of steam generation and power plant equipment*

**A 1,000-MW generator**

An engineer of the Westinghouse Electric Corporation has predicted that turbine generators rated at 1,000-MW, twice as large as any now in use, will be producing power in the United States within the next 15 years. The largest unit in operation in the country today is rated at 475-MW. Clarence J. Baldwin, an electric utility engineer, said that Westinghouse has determined that the higher-rated units can be operated economically, after a two-year study of the problem using a method called "Powercasting." "Powercasting" involves the use of computers to simulate detailed operations of a utility in the future. In effect, by programming the future into a computer, utility specialists are able to build a model electric system, in the computer, that will actually operate like a full-scale system. The 1,000-MW pattern proved economically superior to one restricted to 500-MW units over the next 20 years, he reported. Its economic superiority was unchanged by variations in installed plant cost. The study showed that patterns using units larger than 1,500-MW could be economical were it not for increasing internal transmission costs with the very large units. The 1,500-MW units would not be excessively large as far as reserves are concerned. However, the concentration of capacity in one location on some utilities increases transmission costs enough to overcome the economies of the 1,500-MW unit. (*Combustion*, Vol 32, No. 6, p. 53.)

**New packaged power plant**

Mr. J. M. Costello, executive vice-president of the South Carolina Electric and Gas Company, recently announced the purchase, by his company, of four General Electric Company gas-turbine packaged power plants. Mr. Costello said that the use of natural-gas as a fuel was an important consideration in his company's interest in the General Electric packaged plant as the South Carolina Electric and Gas Company has recently installed more than 200 miles of natural gas transmission lines in its 23-county transmission area. The gas-turbine power plant is a compact, self-contained generating station capable of operating on a system in conjunction with other generating equipment, or at a completely isolated location. It can be started without any external source of power, and can be working at full-load in approximately 15 min. The overall dimensions of the packaged power plant which has been installed, are approximately 80 ft. long and 35 ft. wide. The plant has a net station rating for peak-load service of 10,750 kW. It is a complete and integrated power plant consisting of two basic units plus ancillary equipment. (*Combustion*, Vol. 32, No. 6, p. 40.)

**Floating power station for first ballistic-missile warning site**

One of the world's largest floating power stations, the ship "YFP-10," is now providing electricity for the first B.M.E.W.S. (Ballistic-Missile Early Warning System) installation. Burns and Roe, of New York, has been awarded a contract by R.C.A.'s Defence Electronic Products Division to operate and maintain the station, as well as shore-based transmission and substation facilities. B.M.E.W.S. is the warning system which will afford approximately 15 min. advance notice to the North American continent in case of ballistic missile attack. The ship, now supplying power to the site, was formerly a dry-cargo vessel. Its propulsion machinery was removed to make room for boilers, generators, evaporators, condensers, and electric power equipment. Recommissioned the "YFP-10" in 1954, the ship is towed wherever it is needed. Over-all, the craft is nearly 340 ft. long, with a 50-ft. beam, and draws 20 ft. of water, fully loaded. Independent of shore facilities, "YFP-10" can reach full-power output in four hours, and can be operated at normal power-output for up to 30 days without refuelling. Boiler make-up may be zeolite-softened fresh water from an Arctic lake, or, in an emergency, may be produced from salt water by a 20,000 gal./day capacity evaporator. The ship's three top-fired boilers supply a total of 123,000 lb./hr. of steam at 650 lb./sq. in. g. and 830 deg. F., to three 16-stage, impulse-type turbines rotating at 3,600 r.p.m. A complete control room and switchgear are installed aboard the "YFP-10." Equipment in the ship's four holds includes (1) electrical controls, fuel, water storage; (2) turbo-generators, exciters, condensers; (3) boilers, heat-exchangers, fans, evaporators, and (4) administrative offices, maintenance shops, and crew quarters. The power plant control room is located between boiler and turbine rooms for convenience. Power from the ship's generators is transmitted at 13.8 kV to stations A, C, and D, and stepped down to 4.16 kV at sub-stations C and D for nearby base distribution. At substation A, power is stepped up to 69.0 kV for distribution to substation B, which provides power for the site's electronic equipment. "YFP-10's" first responsibility is to supply electricity to the B.M.E.W.S. site. However, provisions have been made to utilise any excess capacity. For example, a dockside desuperheater converts excess high-pressure steam to saturated steam for use in the base heating-system. A lagoon, formed by earth-filled caissons, completely surrounds the "YFP-10" to protect it from violent seas. Because of the area's 7-ft. tides, and the ship's unusual function, a novel mooring arrangement was necessary. Guides, welded at intervals against the hull, allow the ship to slide up and down along H-beams welded to caisson piling. The moorings prevent the ship from rolling, pitching or drifting away, but they create another problem—ballasting. Because the ship is held fast along one side only, ballast must be carefully regulated to keep her on an even keel. If, for any reason, the ship were to develop a list to one side, she would tend to bind in her moorings, and so be unable to move either up or down with the tide. "YFP-10" is operated 24 hours a day by a 33-man crew, directed by Burns and Roe's power

# Now you can record from 2 to 24 points on one Honeywell ElectroniK Recorder

***The new UNIVERSAL Honeywell Multi-point Potentiometer — another great achievement in ElectroniK design***

First the Modular development simplified ElectroniK design and maintenance. Now Honeywell introduce an ElectroniK potentiometer that increases the scope of accurate multi-point recording — variety of points, speedy change of range and type of measuring elements. 2, 3, 4, 6, 8, 10, 12, 16, 20 or 24 points can now be recorded on every Honeywell multi-record non-control recorder. Changeover is easily made in seconds.

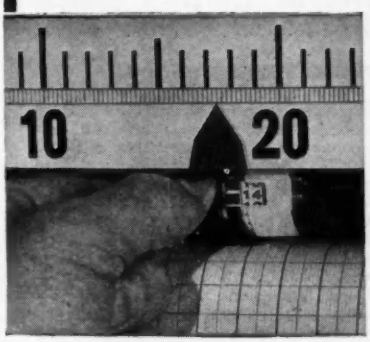
**All you have to do**

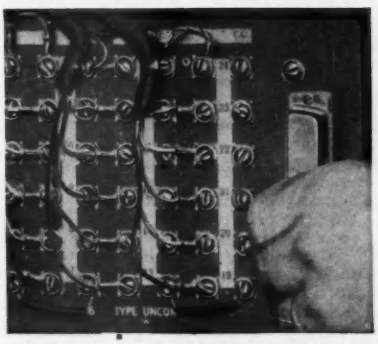
Replace print wheel-cum-indicator dial, fixed by a thumb nut.

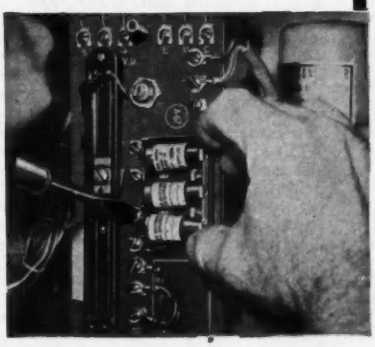
Replace shorting plug unit on special input terminal board inside the instrument.

Change the range of the instrument by slipping in new resistors.

*Different detectors can be compensated for by introducing new input terminal board.*





**Honeywell**

First in Control

SINCE 1885

**Write or send the coupon today to Honeywell Controls Limited Greenford, Middlesex. Waxlow 2333**

*I am interested in the new Universal ElectroniK Recorder. Please send me* Spec. Sheet 153-23-HB

Name.....

Position.....

Company.....

Address.....

.....EBHR

Sales Offices in the principal towns and cities in the United Kingdom and throughout the world.

ship manager, and three stationary engineers.

**Molten salt reactor experiment at Oak Ridge**

A reactor experiment of the molten-salt type will be constructed at the Oak Ridge National Laboratory to investigate advanced reactor concepts having potential advantages for production of electrical power. Design of the reactor, to be known as the Molten Salt Reactor Experiment (M.S.R.E.), is currently being carried out by O.R.N.L. with some assistance by personnel from Burns and Roe, architect engineers of New York. Oak Ridge National Laboratory is operated by the Union Carbide Corporation for the United States Atomic Energy Commission. The major objectives of the M.S.R.E. are to demonstrate the dependability, serviceability, and safety of the molten-salt reactor concepts for civilian power purposes, providing confirmation of earlier experimental work, and information on components needed for a larger reactor. The molten-salt reactor concept offers the potential economic advantages of excellent steam conditions and higher efficiency, through operation at very high temperatures and specific power. Since the fuel is in solution, no fabrication of fuel elements is necessary, and continuous removal of fission poisons is possible. (*Combustion*, Vol. 32, No. 5, p. 54.)

---

**Dearborn-Pittam Water-Treatment Service**

The licensing agreement which has been concluded between **John Pittam & Co. Ltd.,** water treatment specialists, The Adelphi, John Adam Street, London, W.C.2, and the **Dearborn Chemical Company,** Chicago, U.S.A., is claimed to represent a major advance in the field of industrial water-treatment service. The alignment of Pittam & Co. Ltd. with Dearborn will, it is stated, enable their clients to benefit from the progressive developments associated with the Dearborn name, and allows Pittam & Co. Ltd. to offer in the United Kingdom any of their specialised formulations and techniques, both in water-treatment and in chemical cleaning. Pittam's are also now licensed to manufacture in this country any of the Dearborn patented water-treatment chemicals. Amongst these are the polyoxides used as anti-foaming agents and their improved form of octadecylamine for protecting steam systems. The agreement includes full consultative facilities and access to all their research and development data. John Pittam & Co. Ltd. is one of the three companies forming the water-treatment division of the Forestal Group. The others are Tannin Developments Limited, and Owen & Green Limited. Together, these companies provide a comprehensive water-treatment service. The group is experienced in the specialised aspects of industrial, railway and marine applications, and employs a team of graduates in a comprehensive development unit at its factory near Widnes, Lancs., to develop new products and evolve improved techniques in these fields. Tannin Developments Limited has, during 30 years, developed water treatment compounds largely in conjunction with British and overseas railways, for after-conditioning softened-water, the prevention of corrosion and for the complete internal treatment of locomotive boilers, and stationary boiler plants.

* * *

**Weir Valves Limited,** Glasgow (a member of the Weir Group of Companies) and **Pacific Valves Inc.,** Long Beach, California, have entered into an agreement whereby Weir Valves Limited now have the exclusive right to manufacture Pacific Valves Inc. products, and market them throughout the world, excluding U.S.A. Pacific Valves Inc. was founded in 1935 in order to undertake valve repair work, from which they gradually extended their fields of interest and activity to cover all aspects of design and production of a wide range of valves for the oil and chemical markets. They also manufacture specialised valves for American rocket and space-research work, and operate a large works and foundry employing approximately 1,000 persons. The company name of Weir Valves Limited has been changed to **Weir Pacific Valves Limited,** which is a combination of the "Weir" know-how in the marine industry, and "Pacific's" standing in the oil and chemical industries. In addition to the present range of valves for marine purposes, there are now being manufactured globe, gate, check and swing check valves in cast and forged steels. Also in production are "Ball-Valves," which are an entirely new type of valve developed by Pacific Valves Inc. It is claimed that key-note of the ball-valve is its simplicity, providing a positive shut-off in either direction by means of a spherical ball and resilient seats, no sealing lubrication being required. The valves are manufactured in both flanged and screwed-end types to B.S.10, A.S.A. and A.P.I. standards, and can be supplied in a variety of body materials (cast-iron, cast-steel, bronze, aluminium and stainless-steel, etc.) combined with several different types of sealing such as Teflon, Viton, Buna-N, etc.

* * *

A recent publication of **Thos. W. Ward Limited** is devoted to the services of their Industrial Plant Department. Backed by the whole resources of the company, this department produces "made-to-measure" systems of plant to fit the needs of any industrial organisation. Additionally, as manufacturers and distributors, they supply a wide variety of plant and equipment, including specialised castings and intricate fabricated components. The publication deals with such installations as horizontal, vertical, and packaged boilers; welded and sectional tanks, and pressure-vessels; ducting and pipework; metal scaffolding and miscellaneous fabrications. Attention is also given to the services of two of the company's subsidiaries—**Dick's Asbestos & Insulating Co. Ltd.** and **Anchor Insulating Co. Ltd.**—who specialise in every aspect of industrial and domestic thermal insulation. For all these applications, Wards provide a full consultative and advisory service, based on their combination of technical knowledge and wide experience. This new brochure—entitled *Industrial Plant*—is available from Thos. W. Ward Limited, Albion Works, Sheffield, or from their London office at Brettenham House, Lancaster Place, W.C.2.

* * *

**Mr. Basil St. Martyn Frank Webb-Ware,** M.A., A.M.I.E.E., has been appointed assistant chief transmission project engineer to the Transmission Project Group of the Central Electricity Generating Board. After spending some years with A. Reyrolle and Co. Ltd., he was, between 1934 and 1938, a technical assistant in the South-East England office of the Central Electricity Board. His first appointment in the headquarters of the Central Electricity Board was as an assistant engineer in the System Operations Department, a position he held until 1941, when he became assistant construction and contracts engineer. Since March, 1948, Mr. Webb-Ware has been co-ordinating engineer (Specification and Contracts) in the Transmission Construction Branch at headquarters.

* * *

It is with regret that we record the sudden death of **Commander J. R. Patterson,** O.B.E., D.S.C. (R.N. Retd.), A.M.I.Mech.E., M.I.Mar.E., after a very short illness. Commander Patterson became technical secretary at the Parsons and Marine Engineering Turbine Research and Development Association in 1952, after 35 years' service in the Royal Navy.

* * *

**Revised British Standard**

Basic dimensions for hobs required for the production of gears for turbine reduction and similar drives are now recommended for the first time in Part 2 of B.S. 2062, 1960, which has just been revised. It has not been possible to achieve complete agreement on the dimensions, but recommended dimensions are given for these tooth forms and pitches listed in B.S. 1807: Part 2 (which relates to gears for turbines). These dimensions are suitable for the larger hobbing machines used in this type of work. Recommended arbor dimensions are also included to ensure correct fit between hob and arbor. As in the previous edition, accuracy requirements are laid down. The permissible errors given are similar to those in the previous edition but the layout of the table has been improved to make it comparable with Part 1 of the standard, a revision of which was published in 1959. Copies of this standard may be obtained from the **British Standards Institution,** Sales Branch, 2, Park Street, London, W.1, price 10s.

# answer 'Honeywell' to these questions

1 Who have 30 years' experience of making modulating boiler-burner controls?

2 Who provide liquid-filled sensing elements for extra sensitivity?

3 Who design the widest temperature and pressure ranges into their controllers?

4 Who offer the greatest variety of functions— direct, reverse acting, dual function—in one line of modulating equipment?

5 Whose modulating temperature and pressure controllers, and motors, are used by most manufacturers of industrial burners and boilers?

. . . and you will certainly know that simple Honeywell systems for modulating or proportional control are the finest in Britain . . . unsurpassed for reliability and long life . . . supported by the technical resources of Honeywell branch offices in the principal towns and cities in the United Kingdom and throughout the world.

**Honeywell**

First in Control

SINCE 1885

For up-to-date technical information about Pressuretrols, Temperature Controllers and Modutrol motors—

**WRITE OR SEND THE COUPON TODAY:**
**Honeywell Controls Limited, Greenford, Middlesex. Waxlow 2333.**

Please send me the following Instruction Sheets:

Pressuretrols 95-1181
Temperature Controllers 95-1172
Modutrol Motors 95-1416

NAME _____

COMPANY _____

POSITION _____

ADDRESS _____

_____ EBHR

# Latest Power Plant Patents

*These extracts from British Patent Specifications are reproduced by permission of The Controller of H.M. Stationery Office. (Complete British Specifications can be obtained from the Patent Office, 26, Southampton Buildings, London, W.C.2. Price 3s. 6d. each, both inland and abroad.)*

## Control apparatus for boilers

This invention relates to control apparatus for a boiler provided with a combustion-chamber to be fired either by a primary solid-fuel burner, or by a secondary burner. As is well understood, some boilers are provided with primary burners fired by pulverised-fuel and with secondary, or auxiliary burners, fired by oil fuel, which can be brought into operation in the event of a failure of the supply of pulverised-fuel. It is sometimes found that when using poor quality coal, slurry, for example, there is considerable difficulty in obtaining steady firing conditions due primarily to:—(a) damp coal clogging the feeding system, or (b) foreign bodies, such as timber or scrap-metal, jamming the feeders and pulverisers. Handling of this kind of primary solid-fuel sometimes results in a loss of pulverised-fuel supply from the pulveriser to the burners which has an unsteadying effect on the boiler control system as a whole. The boiler unit is usually provided with several sources of primary fuel supply, generally from three or more pulverisers; and if failure of, or reduction in supply occurs from any one or more of the pulverisers, the burner may become very unstable, with the result that there is likely to be a complete loss of ignition. In an effort to stabilise furnace combustion conditions a secondary burner, usually an oil burner, is sometimes provided, and its operation is controlled by a photo-electric cell viewing the interior of the combustion chamber, and initiating operation of the secondary burner in the event of the flame from the primary burner dying down. This form of apparatus is not, however, wholly satisfactory, because the photo-electric cell can only observe what has already occurred, and because the cell observes through a window which often becomes dirty too quickly to be kept clean by frequent cleaning. The dirt on the windows accordingly causes the cell to give a false observation and to bring the secondary burner into operation when it is not needed. The main object of this invention is to provide control apparatus which eliminates the use of photo-electric cells, which will anticipate a primary fuel-supply failure, and which is essentially dependent on the rate of supply of primary fuel to the primary burner. In the outline arrangement (Fig. 1) the combustion chamber (1) is adapted to be fired either by a primary burner (2) which is a pulverised solid fuel burner, or by a secondary burner (3) which is an oil burner having a control panel (4). As is customary, coal is delivered from a bunker (5) to an automatic feeder (6) which operates under control of a regulator device (7) to deliver coal to a pulveriser (8) through an input conduit (9). Pulverised fuel is extracted by a fan (10) through an output conduit (11), and is delivered through it to the burner (2). The control apparatus comprises a first control device (12) which is adapted to receive a steam pressure-indicating signal and to effect its biasing by an amount which is proportional to the loading of the pulveriser (8). The first control device (12) may be a differential pressure controller of any suitable construction, and in one embodiment is a fluid-operated differential pressure controller of the floating proportional type. A controller of this type includes a diaphragm-operated pilot valve (not shown in diagram) which floats on compressed-air delivered to the controller by the line (13) which is connected to a master controller (14) which is, in turn, connected by line (15) to the steam mains. Also connected to this controller are tapping lines (16, 17) which connect the differential pressure controller respectively with the input conduit (9) and the output conduit (11). The arrangement is such that the control point of the diaphragm-operated valve is floating on the compressed-air from line (13) thus having a biasing effect on the system so that an increase in pressure on line (13) demanding an increase in steam rate, gives rise to an increased bias on the differential pressure controller. This permits the differential pressure controller to operate with a substantially constant sensitivity at varying differential pressures for variable boiler loads, and to emit a primary fuel supply-indicating signal. This signal will be representative of the ratio of boiler steam pressure to primary fuel supply, and it is emitted on line (18) to a second control device (19) which may be a summating relay which is also connected by a tapping line (20) to line (13). The second control device (19) summates the steam pressure-indicating and primary fuel supply-indicating signals respectively applied to it from lines (20 and 18) and emits on line (21) a "fuel need" signal indicative of the need of additional fuel in the combustion chamber, to a start device (22).

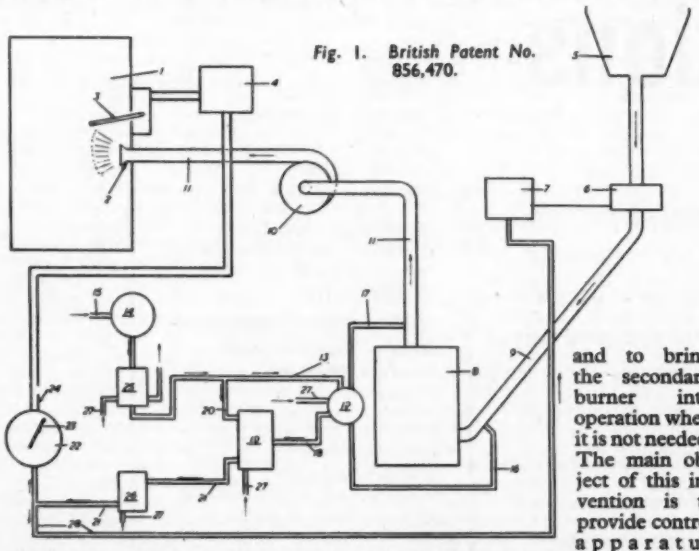
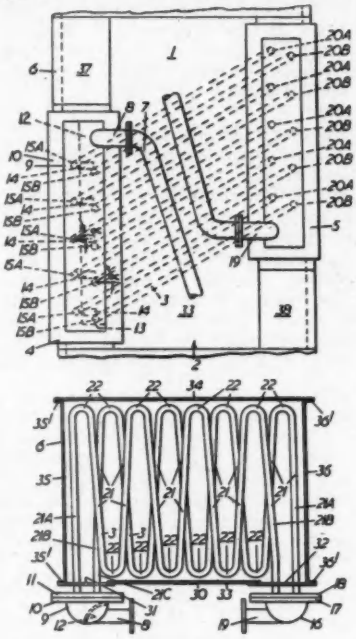


Fig. 1. British Patent No. 856,470.

This device consists of a pressure-gauge the indicator (23) for which is adapted to co-operate with electrical contacts (not shown in diagram) included in an electrical circuit (24) connected to the control panel (4) for the secondary burner (3). The arrangement is such that when the indicator (23) registers a predetermined value, the circuit (24) is closed and so causes the secondary burner to become operative. The steam pressure-indicating signal is applied to the first and second control devices (12 and 19) through a first selectivity operable valve device (25) which is located between the master controller (14) and the control devices, and the fuel need signal is applied to the start device through a second selectively operable valve (26) which is located between the second control device (19) and the start device. The valves (25 and 26) are each adapted for operation either manually or automatically, and act as reducing valves to regulate the air pressure on lines (13 and 21). The valves (25 and 26) and the first and second control devices (12 and 19) are connected in common to an air-supply line (27). In order to effect regulation of the rate of feed of the primary fuel in accordance with the demand of the boiler, a tapping line (28) feeds the fuel-need signal to the regulator device (7). When the boiler is in operation, it is normally fired by the primary burner (2) and the supply of primary fuel to the burner is regulated according to the steaming rate of the boiler by the regulator device (7). The latter is under control of fuel-need signals from line (28) and regulates the rate of operation of the feeder (6). If, however, the strength of the fuel-need signal falls to a predetermined value which indicates an anticipated failure of fuel supply to the pulveriser (8), then the indicator (23) of gauge (22) will be so located as to close the circuit (24) in order to initiate operation of the secondary burner (3) and ensure that the desired steaming rate of the boiler is maintained. When the primary fuel supply has been fully restored, the selector valves (25) and (26) are manually-operated to open circuit (24) and to recondition the apparatus for automatic burner control. *British Patent No.* 856,470 *issued to Central Electricity Generating Board and W. Edley. Complete specification published December 14th,* 1960.

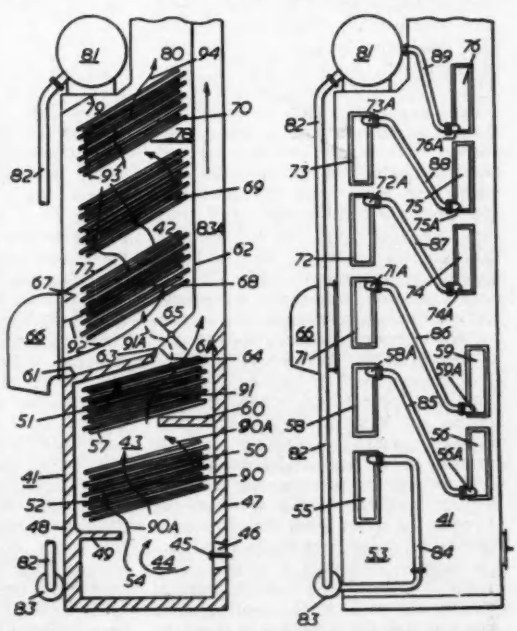
**Tubular heat-exchanger**

This invention relates to tubular heat-exchangers and more particularly to forced-circulation steam generators. The heat-exchanger outlined in Figs. 2 and 3 is located in an upright gas pass (1) arranged for the upward-flow of heating gases as indicated by arrows (2). The tubes (3) are of similar form, and each



*Figs. 2 & 3 (above) and 4 & 5 (right). British Patent No. 856,512.*

comprises a number of tube limbs (21) connected in series by return bends (22) and so set that each is of zig-zag form. The tubes (3) are arranged so that adjacent tube limbs (21) of adjacent tubes are mutually disposed in crosswise fashion and with the return bends (22) of adjacent tubes at a side of the tube bank in staggered relationship. Each tube (3) includes at one end a limb (21A) arranged so that the angle between the end limb (21A) and the next limb of the tube is less than the angle between other pairs of adjacent limbs (21) of tube (3). Alternate tubes (3) are arranged with the end limbs (21A) connected to respective tube apertures (15A) in the distributor, and the other tubes (3) are arranged with their ends (21A) connected to respective tube apertures (20B) in the collector (5). The limbs (21B) at the other ends of the alternate tubes (3) are connected to respective tube apertures (20A) in the collector (5) and the limbs (21B) at the other ends of the tubes (3) are connected to respective apertures (15B) in the distributor (4). The angle between the limb (21A) of each tube (3) and the adjacent limb (21) of the tube is substantially half that of the angle between other pairs of adjacent tube limbs (21) and the arrangement is such that the tube limbs (21A) are substantially normal with respect to their associated tube plate (11 or 18). End portions (21C) of the tube limbs (21B) are bent to extend substantially parallel to the limbs (21A) so that the end portions (21C) are also substantially normal to the associated tube plate (11 or 18). The tubes (3) are inclined across the gas pass (1) as indicated in Fig. 2, with the limbs of each tube lying substantially parallel to a common plane, while the distributor (4) and collector (5) are upright. To this end, planes containing the longitudinal axes of the limbs of respective tubes (3) are inclined to the longitudinal axes of the distributor (4) and collector (5). Thus, as shown in Fig. 2, each tube (3) is inclined at an angle (2) to the horizontal, and the collector (5) is disposed at a level higher than that of distributor (4). Suitable provision is made for draining the heat-



exchanger at the lower end of the distributor, or at the lower ends of both the distributor and the collector. The steam generator shown in outline in Figs. 4 and 5, comprises an upright setting (41) and a lower combustion gas section (43). The latter section has a lower combustion zone (44) with an oil burner (45). The baffle (49) directs combustion gases from the combustion zone toward the centre and the burner side of the setting. In operation, combustion gases from the oil burner (45) are directed from the combustion zone upwardly through the section (50) transversely of the tubes (52) and similarly through section (51), as indicated by arrows (90 and 91), the baffles (49 and 60) serving to direct the flow of gases through substantially the whole cross-sectional area of the heat-exchanger sections (50 and 51) as indicated by arrows (90A). Above the section (51), the arch serves to guide the heating gases to the outlet (61A) where they flow upwards through the exhaust and outlet as indicated by the arrow (91) under the control of an outlet damper (not shown) or into the waste-heat section by way of the passage (64) under the control of damper (65) as indicated by the broken arrow (91A). Waste-heat heating gases, for example, exhaust gases from a gas-turbine, are supplied by way of inlet duct (66) into the waste-heat section (42), and flow inwards and upwards as indicated by the arrows (92). The baffle (77) serving to guide the waste gases through substantially the whole cross-sectional area of the section (68). Gases leaving the section (68) which may comprise both waste heat gases from the inlet duct (66) and the combustion gases from the passage (64), flow upwards through the section (69) and are guided by means of baffle (78) to flow upwards into the uppermost section (70) and through this section to the upper exhaust outlet (80) as indicated by arrows (93 and 94). The steam generator may be operated with oil firing alone, when, for example, no waste gases are available. In this case, the damper (65) is opened, in the position shown in Fig. 4, and the damper in the exhaust outlet (83A) is closed so that the combustion gases from the oil burner (45) pass upwards through the heat-exchangers (50 and 51) and then upwards through the heat-exchangers (68, 69 and 70). As the heating gases rise through the tube banks they are cooled, and the reduction of cross-sectional area of the waste-heat section (42) advantageously tends to maintain the upward gas-flow velocity at or close to an optimum level. Alternatively, the steam generator may be operated without oil-firing and with waste-heat gases alone, in which case, the damper (65) is closed and no heating takes place in the lower heat-exchanger sections (50 and 51). *British Patent No.* 856,512 *issued to Spencer-Bonecourt-Clarkson Limited. Complete specification published December 21st,* 1960.

**Nuclear cum gas turbine plant**

This patent envisages a combined nuclear and gas turbine cycle. In Fig. 6, a fluid medium in the form of a gas (for example, carbon dioxide) is circulated by blowers or pumps (10) driven by a gas turbine (71) as a coolant through a nuclear reactor (100) and as a heating fluid through a steam generator including four heat-exchangers or boilers (25, 26, 27 and 28) and a heat-exchanger or economiser (30). The boilers are successively traversed by the heating fluid to generate steam at progressively lower pressures. It will be appreciated that each boiler produces steam at a pressure which corresponds to the gas outlet temperature from the boiler. As a result, even with heating fluid of relatively low temperature, for example, of the order of 350 to 400 deg. C., steam at high pressure may be obtained with accompanying advantages as regards its use. The boilers are connected in series so far as the feedwater is concerned, each succeeding higher pressure boiler being fed with a proportion of the water from the preceding lower pressure boiler. In the particular arrangement outlined, heating fluid at the highest temperature enters the boiler (25) through a duct (21) leading from the nuclear reactor and flows from the boiler (25) to the boiler (26), the fluid entering the boiler (26) being joined by hot fluid which is led through a duct (22) from the nuclear reactor, and which is at a somewhat lower temperature than the fluid supplied through the duct (21). The combined stream of fluid from the ducts (21 and 22) flows in series through the boilers (26, 27 and 28). Some of the fluid flows from the boiler (28) through the economiser (30) and is returned to the nuclear reactor (100) through a duct (24). The remainder of the fluid discharged from the boiler (28) is returned to the nuclear reactor through a duct (23). The boiler (25) through which the fluid of the highest temperature, for example, 355 deg. C. passes generates steam at high-pressure, for example, 70 atmospheres (990 lb./sq. in.). The gases are cooled in the boiler (25) to a temperature approximately equal to that of the hot gases supplied through the duct (22), for example, 305 deg. C. and, mixed with these gases, pass successively through the boilers (26, 27 and 28) which, for example, may respectively generate steam at 27 atmospheres, 12 atmospheres and 2.5 atmospheres (283, 170 and 35 lb./sq. in. respectively). The economiser (30) ensures the cooling to a predetermined temperature of 70 deg. C., for example, of a predetermined fraction of the fluid, which leaves the boiler (28) at a temperature of 145 deg. C. A feed-pump (31) supplies the economiser (30) through a pipe (32) with the quantity of water necessary for effecting the desired cooling of the fluid discharged through the duct (24). The excess water is carried by an extension (34) of the economiser outlet pipe (33) to an expansion drum (35), whilst the feedwater necessary for the steam generator is supplied by a pipe (36) and a feed-pump (37) to a steam and water drum (38) of the lowest pressure boiler (28). A part of this water is taken by a pump (39) and introduced into a water and steam drum (40) of the lower medium-pressure boiler (27). A part of the water from the drum (40) is taken by a pump (41) and introduced into a water and steam drum (42) of the upper medium pressure boiler (26), and a part of the water from the drum

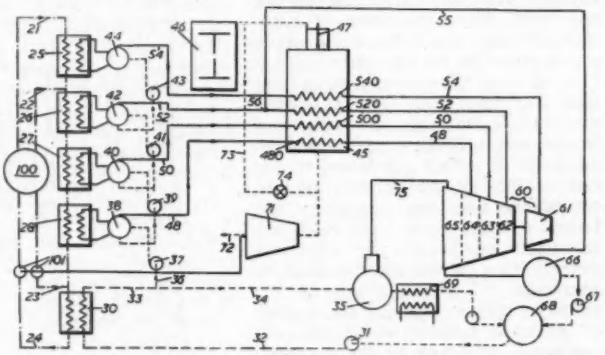



*Fig. 6. British Patent No. 856,632.*

(42) is taken by a pump (43) and introduced into a water and steam drum (44) of the high-pressure boiler (25). The saturated steam supplied at decreasing pressures by the drums (44, 42, 40 and 38) is taken by the steam lines (54, 52, 50 and 48) respectively, to the stages (61 to 64) of a steam turbine (60). In the lines (54, 52, 50 and 48, respectively) are included superheaters (540, 520, 500 and 480) of steam heating means (45) in which these superheaters are disposed in succession in a path for heating gases. The steam heating means (45) comprise a combustion chamber which is arranged to burn an appropriate fuel, for example, oil introduced by a burner (47) and which is supplied with hot combustion air under pressure in the form of the exhaust gases from a battery (46) of free piston compressors connected in parallel. The steam leaving the high-pressure stage (61) of the turbine is led by a steam-line (55) to the inlet (56) of the superheater (520) for the upper medium pressure steam, and is supplied together with the latter steam by the line (52) to the following stage (62) of the turbine (60). The turbine also includes a very low-pressure, for example, 0.5 atmospheres (7.1 lb./sq. in.) stage (65) of the turbine (60), which utilises the saturated steam brought from the expansion drum (35) by a saturated steam line (75). The steam discharged from the turbine (60) is condensed in a condenser (66) the condensate being returned by an extraction pump (67) to a feed-tank (68) to which water coming from the expansion drum (35) is also returned after passing through a cooler (69). The flue gases having passed through the steam heating means (45) are expanded in the gas-turbine (71) and then discharged through a duct (72) to a chimney (not shown in diagram). Normally, the gases in the turbine will be at a temperature in the order of 300 deg. C., but, by properly designing the turbine (71) and by careful choice of the materials from which it is made, it can withstand gases at considerably higher temperatures. Since the turbine (71) can withstand this overload, a by-pass (73) controlled by a valve (74) is provided across the steam heating means (45), so that all the gases from the compressor can be admitted, in case of need, directly to the turbine (71). The temperature of the gases in the turbine would then be in the order of 500 deg. C., and the overload would be in the order of 30 per cent. *British Patent No. 856,632 issued to Babcock & Wilcox Limited. Complete specification published December 21st, 1960.*

**Steam power plant with forced through-flow steam generator**

This invention relates to a power plant incorporating a forced through-flow steam generator. Fig. 7 shows, in outline, such a steam generator (1) from the final superheater (2) of which, a live steam line (3) leads to a turbine installation (4). The condensate accumulating in a condenser (5) is fed as feedwater by a condensate pump (6) to a feedwater line (7). This line forks at a branch point (8) into two parallel lines (9 and 9′). The line (9) includes feedwater preheaters (10, 11, 12, 13, 14 and 15) heated with steam tapped off from the turbine installation (4) and a starting vessel (16), while the line (9′) includes feedwater preheaters (18, 19, 20 and 21) heated with steam separated in an expansion column (17). Working medium extracted from the steam generator (1) at an extraction point between the vaporiser heating surface and the superheater heating surface, passes through a water separator (23) and thence through a line (24) tangentially into the expansion column (17) in which it is expanded in each stage. The residual water accumulating in the

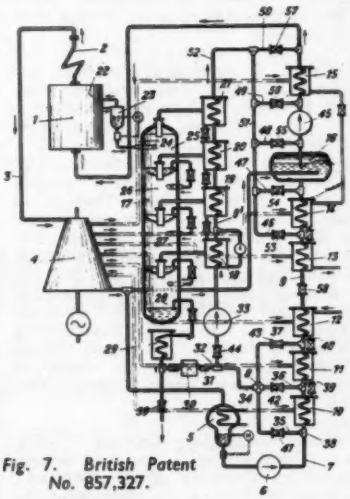


*Fig. 7. British Patent No. 857,327.*

last separating stage (28) and having a high salt concentration, passes through a cooler (29) to a salts removal plant (30) and thence through a throttle valve (31) and a connecting line (32) to a feedwater pump (33) in the line (9′). Between the feedwater line (7) and the line (9′) is a connecting line (34) which is connected to the line (9) by three branch lines (35, 36 and 37) at the points (38, 39 and 40) respectively. The branch line (35) contains a throttle-valve (41), the branch line a throttle valve (42) and the branch line (37) a throttle valve (43). The line (9′) includes a flow regulating valve (44) at its water inlet end. Depending on whether the line (9′) is fed from the connection point (38, 39 or 40), the feedwater enters the line (9′) with a lower or higher temperature. The fractions of the total quantity of feedwater flowing through the two parallel lines (9 and 9′) are determined by appropriate adjustment of the flow regulating valve (44) and one of the throttle valves (41, 42 or 43) or, with the throttle valves fully-open, by adjustment of the deliveries of the feedwater pumps (33 and 45). In parallel with the water outlet ends of the two lines (9 and 9′), is disposed a third line (51) which is connected to the line (9) by branch lines (46, 47, 48, 49 and 50) and which discharges into an end connecting line (52) of the line (9′). The branch lines (46, 47, 48, 49 and 50) contain shut-off valves (53, 54, 55, 56 and 57) which enable the heated feedwater flowing from the line (9′) to be reunited, at a point where the temperature level corresponds to its own temperature, with the feedwater in the line (9). The flow in the line (9) can be adjusted by flow regulating valve (58). The residual water from the separating stage 28 can also be discharged through a drain valve (59). *British Patent No. 857,327 issued to Sulzer Fréres S.A. Complete specification published December 29th, 1960.*

---

**Sir Roger Makins,** G.C.B., G.C.M.G., chairman of the United Kingdom Atomic Energy Authority, represented H.M. Government at the formal opening of the Canada-India reactor at Trombay, India, on Monday, January 16th, 1961. Sir Roger also took part in a symposium which was held at Trombay on January 17th and 18th, at which he and Sir John Cockroft, a part-time member of the U.K.A.E.A., presented aspects of the U.K. nuclear power programme. Afterwards, in company with representatives of other governments, he undertook a short tour in India as a guest of the Indian Government. The Canada-India reactor was a gift to India by Canada under the Colombo Plan. All internal costs of erecting the reactor have been borne by the Indian Government. The reactor, which is for research purposes, is heavy-water moderated, light-water cooled, natural uranium fuelled, and is designed to produce 40 megawatts (thermal). Work on the reactor began early in 1956.

* * *

After 21 years as secretary of the North-East Coast Institution of Engineers and Shipbuilders, **Mr. T. S. Nicol** has retired.

* * *

Babcock & Wilcox Limited announce that **Mr. C. H. Davy,** resident director of their Scottish works since 1951, is returning to London where he is taking up duties at the Euston Road head office on February 1st, as an executive director.

# NOTES *Personal* AND *Industrial*

In view of the expansion of the Weir Group, **Viscount Weir,** C.B.E., chairman of G. & J. Weir Holdings Limited, has resigned from the board of the principal subsidiary company, G. & J. Weir Limited, in order to devote more time to the overall administration of the group. **Mr. J. Russell Lang** is now chairman of G. & J. Weir Limited, and is succeeded as managing director by **Mr. J. W. Atwell,** M.Sc. **The Hon. W. K. J. Weir** has joined the board of G. & J. Weir Limited, as an additional director. Viscount Weir is also resigning from the boards of Weir-Catton Limited and Weir Foundries Limited.

* * *

**Mr. D. R. S. Turner,** who was, until recently, commercial manager of the turbine-generator division, Trafford Park, of A.E.I. (Manchester) Limited, has been appointed director and general manager of Davidson & Co. Ltd., Sirocco Engineering Works, Belfast.

* * *

**Mr. R. E. J. Putman,** A.M.I.Mech.E., has rejoined James Gordon & Co. Ltd. as chief engineer, after having spent several years in England and in Canada, engaged on the application and development of electronic control equipment and systems for power stations, and industrial installations.

* * *

**Mr. J. P. V. Woollam,** M.I.Chem.E., has been appointed deputy chairman of Simon-Carves Limited. Mr. Woollam joined Simon-Carves in 1916, and was appointed a director in 1945, and a joint managing director in 1953. He is also a director of the holding company, Simon Engineering Limited, and of a number of subsidiary and associated companies.

* * *

**Mr. F. G. Hughes** has been appointed Southern sales manager in the London office of Robert Dempster & Sons Ltd. (Elland), at 57, Tufton Street, S.W.1.

* * *

**Mr. W. Latta** has been appointed director and general manager of Rhodes, Brydon & Youatt Limited, following the acquisition of that company by Crane Limited, of London and Ipswich.

* * *

**Mr. P. R. Armitage,** A.M.I.Loco.E., has been appointed manager of the Traction Division of The General Electric Co. Ltd., in succession to **Mr. W. D. Morton,** whose promotion to assistant general manager of the company's Witton Works was announced recently.

* * *

Midland Heating & Ventilation Co. Ltd. announce that **J. B. Mattei,** M.A. (Cantab.), B.Sc., A.M.I.Mech.E., has been appointed to their London sales organisation. Mr. Mattei will also be responsible for the London sales department of their associate company, Carter Thermal Engineering Limited.

Owing to continued ill health **Mr. R. Clarke,** O.B.E., M.I.Mar.E., has resigned from the board of Laurence, Scott & Electromotors Limited, of which he was marine sales director, after 48 years' service with the company. **Mr. J. B. Wormall,** M.I.E.E., formerly industrial sales director, is now sales director for all the company's products. **Mr. J. Callf,** who was chief estimator in the Marine Department, has become marine sales manager, and is succeeded by **Mr. B. Kidd.**

* * *

The Harland Engineering Co. Ltd., B.E.P. Works, Alloa, Scotland, announces the appointment of **Mr. A. C. Wood-Parker,** B.A. (Oxon.), C.A., as a director of the company.

* * *

**Sir John Wrightson,** Bt., chairman and managing director, Head Wrightson & Co. Ltd., has joined the board of A. Reyrolle & Co. Ltd.

* * *

**Mr. F. D. Pratt,** personal assistant to **Mr. G. S. C. Lucas,** O.B.E., director and chief engineer, A.E.I. (Rugby) Limited, retired on December 23rd, 1960, after nearly 52 years' service with the company.

* * *

**Mr. L. J. Garibaldi** has been appointed manager, Steam and Gas Turbine Division, of The English Electric Co. Ltd., at Rugby, on the retirement of **Mr. A. Friswell,** general manager of the Steam Turbine Division. Mr. Garibaldi, who has been contracts manager, Steam Turbine Division at Rugby, since 1955, will be responsible to the general manager (Rugby and Whetstone) for all commercial activities concerning turbines, and for the co-ordination of policy in engineering, sales and contracts. Mr. Friswell, M.I.Mech.E., who is aged 60, is retiring at his own request. He joined English Electric in 1921 end was appointed general manager, Steam Turbine Division, in 1949.

* *

Crofts (Engineers) Limited, Thornbury, Bradford, announce that, following recent alteration of the company's Articles of Association authorising the appointment of sectional directors, four executives of the company have now been affected within this category. They are as follows:—**Mr. H. Goldthorpe,** works director; **Mr. C. Mason,** branch works director; **Mr. A. Hearn,** production control director; and **Mr. S. W. Ball,** foundry control director.

* * *

Evershed & Vignoles Limited announce that their district office at 14, Yarm Lane, Stockton-on-Tees (telephone: Stockton 64288) is now under the supervision of **Mr. D. Watson.** The area covered from this office includes Northumberland, Durham, and the Cleveland district of Yorkshire.

**Mr. C. R. Wheeler,** chairman of Guest Keen Iron and Steel Co. Ltd., additional vice-chairman of Associated Electrical Industries Limited, and a director of The Steel Company of Wales Limited, has succeeded **Mr. R. F. Summers,** chairman of John Summers and Sons Ltd., as president of the British Iron and Steel Federation on January 1st, 1961.

* * *

Constructors John Brown Limited, Eastbourne Terrace, Paddington, London, W.2, announces that its automatic control division has been formed into a wholly-owned subsidiary company known as Automatic Control Engineering Limited. Directors of the new subsidiary are: **Mr. I. J. Crosthwaite,** chairman; **Mr. H. D. Walker,** M.I.Mech.E., **Mr. B. Riley,** M.I.Mech.E., **Mr. H. H. Rosenbrock,** M.I.E.E., and **Mr. M. P. Atkinson.** Mr. Riley will also hold the position of general manager, and Mr. Atkinson that of chief engineer. The address of the company is Roxby Place, Seagrave Road, Fulham, S.W.6 (telephone: Fulham 7761).

* * *

**Mr. J. Ivan Spens** has retired from the board of directors of John Summers and Sons Ltd. **Mr. Stephen A. R. Gray** and **Mr. Peter J. Summers,** assistant general managers of the Shotton Works, have been appointed directors of the company.

* * *

**The Firth Cleveland Group** have acquired the lease of 7, Cleveland Row, St. James's, London, S.W.1, a large block adjacent to the Group's headquarters at Stornoway House, Cleveland Row. The new offices will be occupied by the Home Sales Divisions of **Simmonds Aerocessories Limited, Firth Cleveland Instruments Limited,** and **Surform (Firth Cleveland Tools Limited),** and Home and Export Sales Departments of **British Lead Mills Limited, Seculate Limited** and **Richard Hill Limited.**

* * *

The iron and steel making companies of the **G.K.N. Group,** of which **Guest Keen Iron & Steel Co. Ltd.** is one, have been amalgamated under the name of **G.K.N. Steel Co. Ltd.** The business conducted by Guest Keen Iron & Steel Co. Ltd. will continue under the name of Guest Keen Iron & Steel Works (branch of G.K.N. Steel Co. Ltd.), under which name all transactions on behalf of this branch will be conducted and to which communications should in future be addressed.

* * *

The Sales Department of **G. A. Harvey & Co. (London) Ltd.** is now operating from Villiers House, Strand, London, W.C.1 (telephone: Whitehall 9931/7). The company's London showroom will shortly be opened in the same building.